12-2018

The Impact of Goal Persistence and Willing to Compete on Community College Student Success in Developmental Math Coursework

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THE IMPACT OF GOAL PERSISTENCE AND WILLING TO COMPETE ON COMMUNITY COLLEGE STUDENT SUCCESS IN DEVELOPMENTAL MATH COURSEWORK

A Dissertation
Presented to
the Graduate School of
Clemson University

In Partial Fulfillment
of the Requirements for the Degree
Doctor of Philosophy
Educational Leadership

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by
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December 2018

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ABSTRACT

Community college practitioners are seeking innovative approaches to improve student retention and completion rates while also demonstrating the value of a community college education for students, families, and communities. Developmental education for underprepared students is a focal point for institutional reform efforts to impact student success because developmental education programs receive criticism for being a hindrance to college completion. One such criticism is that colleges use ineffective course placement practices to place students into developmental course pathways that they are unlikely to complete. In response to this criticism, institutions have adopted course placement practices that utilize multiple measures to determine the appropriate course level instead of relying solely on traditional cognitive measures, such as standardized tests, to predict student success. Many institutions seek insight from the use of non-cognitive predictors of success such as ratings available through the use of instruments such as Angela Duckworth's Grit Scale or Emotional Intelligence questionnaires introduced by Daniel Goleman. The present study examined the relationship between students' developmental math course grades and two non-cognitive traits measured by the TypeFocus™ Success Factors Questionnaire: (1) Willing to Compete and (2) Goal Persistence. The correlational research design aims to identify possible applications for using a measure of non-cognitive traits among community college students to inform a more accurate course placement process for developmental mathematics students.

DEDICATION

This dissertation is dedicated to the many friends and family members who have supported me during my academic journey. I am thankful to have so many who cheered from the sidelines, prayed for my success and strength both when I needed it the most and when I did not know I needed it, and provided simple acts of kindness that meant more than I can adequately express.

My gratitude extends beyond measure for my husband Scot, who made my goal his own and joined me on this roller coaster ride over the last five years. I would not have accomplished this milestone without your love, unwavering support, and occasional dose of tough love. Your commitment to our children and maintaining a balance in our home while I strived to finish what I started is awe inspiring – you are our blessing and I love you.

To my daughters, Chloe Jordin and Sophie Ariel, you motivated me more than you will ever know. Simply knowing that your young eyes were watching kept me going, even when I considered quitting. I pray that you remember the lows as much as you celebrate the highs. Have the courage to set goals, fight for your dreams, and never give up. You, my strong girls, each have your own God-given purpose, so use that power to do amazing things!

Thank you to my Heavenly Father for being an ever-present source of hope and grace, who held me through this journey, and who orders my steps that I may experience immeasurable joy.

ACKNOWLEDGMENTS

I am honored to acknowledge those in academia who guided me down a path that was unfamiliar while offering me the opportunity for growth through new challenges. I am thankful for the guidance and support that I have received from Dr. Tony Cawthon, who has been with me since my start as a doctoral student, and remained consistent throughout my journey. There are several others who contributed to my process in a variety of ways, and I'd like to thank Dr. James Satterfield, Dr. Rachel Wagner, Dr. Michelle Boettcher, Dr. Jennie Farmer, and Dr. Hans Klar for the many ways you directed my steps at different stages to ensure my success. Thank you to each of you for the work you do to advance the field of education.

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CHAPTER I

INTRODUCTION

Introduction

The lack of academic success among community college enrollees produces a ripple effect, impacting the success of individuals and their families and hindering the health of the workforce and economy as a whole (Bailey, 2017).

> Over the last few decades, the importance of a college education has grown for society and for individuals. This is reflected in the large earnings gap between individuals with a high school degree and those with a postsecondary credential. However, most students who start in community colleges never complete a degree or certificate. This constitutes a failure for those students to achieve their goals and represents a loss of potential earning power and economic growth and activity for the economy as a whole. (Bailey, 2017, p. 33)

In today's higher education climate, community college professionals are hard-pressed to improve student outcomes. Local economic and workforce leaders await a viable solution to the community college student retention and success issue, recognizing that improved community college outcomes will yield dividends for individuals, the colleges, and the workforce that becomes stronger when community colleges thrive.

In a working paper for the Community College Research Center (2005, September), authors Bailey, Jenkins, and Leinbach explained that each year in the United States, the Integrated Postsecondary Education Data System (IPEDS) requires community college researchers and administrators to report data about "student success" based on factors such as the number of students who persist, successfully graduate from an institution or transfer to another

school, and the amount of time it takes students to accomplish their desired outcomes. Institutional effectiveness professionals from each college must report outcome measures in alignment with IPEDS, a system which receives criticism for inadequately painting the full picture of student success (American Association of Community Colleges, 2000). Despite the IPEDS reporting requirements, Boggs (2009) expressed concerns that this system inadequately reflects community college outcomes. Boggs (2009) stated a, "lack of commonly accepted performance measures for community colleges has often led to a misunderstanding of the institutions and an underestimation of their effectiveness and the contributions they make" (pp. 9-10). Like Boggs (2009), many practitioners in the higher education field recommend changes to IPEDS reporting requirements and measures of success, but institutions must currently compete through the lens of this reporting system (Atchison & Hosch, 2016).

In addition to data regarding enrolled student success, institutions annually report data related to graduate employment post-graduation, salaries, time-to-employment, and similar factors that point to community college impacts on individuals and the workforce. Federal and state legislators, compliance officials, programmatic and institutional accreditation bodies, local K-12 education systems, city and local governments, business and industry, and students themselves have implored America's colleges and universities to reform higher education and compete more adequately within the global economy (Boggs, 2009). These constituents of post-secondary education have pressured the higher education field to improve outcomes, reduce student costs, strengthen access, and demonstrate the return on investment for a college education (Community College Research Center, 2005, September). In the wake of this demand, public and private institutions are working diligently to ensure positive student outcomes. Within the community college sector, decision-makers and scholars are striving to identify initiatives

and best practices geared at increasing the percentage of students who complete their educational goals within their chosen institution. Best practices have commonly focused on admission practices, approaches to course placement, identifying and measuring learning outcomes, campus-wide student engagement, integrated support for learners, and classroom practices that maximize student success (Center for Community College Student Engagement, 2016; Keeling, 2004; Keeling, 2006*)*. Despite the concerted effort to strengthen community college initiatives and impact student success, there persist concerns regarding low degree completion rates among community college students (Center for Community College Student Engagement, 2005, September).

Statement of the Problem

Efforts to improve completion rates among community college students aim to create clearer curriculum pathways to college completion, better support structures to encourage student success, and a reduction of barriers to graduation (Center for Community College Student Engagement, 2016; Ruffalo Noel Levitz, 2015). These efforts typically focus on two key areas: (a) institutional practices, and (b) student traits and behaviors. There exists a body of higher education research that examined student traits and behaviors, as well as related institutional practices, which impacted student persistence and retention (Fike & Fike, 2008; Hawley & Harris, 2006).

One challenge within higher education is to identify the perfect combination of student traits, academic readiness, and responsive institutional practices to maximize student success and mitigate risk factors that negatively impact eventual completion of academic credentials (Cohen, Brawer, & Kisker, 2013; Ruffalo Noel Levitz, 2015). The struggle to identify student and institutional traits that support success carries additional unique barriers within America's

community college environment, and it becomes challenging to know which institutional practices will best off-set students' shortcomings. Cohen, Brawer, and Kisker (2013) stated, "It is difficult to disaggregate the effects of community colleges from the characteristics of the students who enter them. In general, students who enter community colleges instead of universities have lower academic ability and aspirations and are from a lower socioeconomic class" (p. 61). Although many students enter today's community colleges with deficits, there exists value in examining to what extent the institutions themselves hinder academic success.

Within America's two-year institutions, there exists an ongoing dialogue related to the effectiveness of developmental education, sentiments about the academically underprepared nature of today's high school graduates, praises about the diverse nature of community college student bodies, and challenges that arise when using antiquated instructional pedagogy at all academic levels and from dramatically varied educational and social backgrounds (Cohen, Brawer, & Kisker, 2013). The commonly held belief is that these risk factors negatively impact student persistence and retention, and these issues repeatedly appear in literature about community colleges and the retention conundrum (Century Foundation, 2013; Crisp & Delgado, 2014; Young, 2002). Today's focus on retention initiatives addresses the reduction in state and federal funding for America's two-year institutions and the high level of dependence on tuition dollars in the absence of other funding sources. Coupled with this fiscal reality, most colleges spend more funding on recruiting students than they do retaining students (Raisman, 2008). As such, it becomes clear why higher education institutions want to retain students so they can count on recurring tuition dollars and avoid the high costs of student recruitment (Ruffalo Noel Levitz, 2015).

The pressure to improve student retention rates has lead leaders and administrators within community colleges to seek opportunities to improve student success rates throughout the colleges, with a focus on various at-risk populations enrolled within these two-year institutions. Developmental education was one such opportunity. Few community college programs underwent more scrutiny and examination than developmental education (Crisp & Delgado, 2014). The enormous costs of remediation to institutions, taxpayers, federal and state financial aid programs, and the students themselves were among the common challenges identified amidst the ongoing debates about efficiency and effectiveness in developmental education programs (Crisp & Delgado, 2014). As this national dialogue deepened, additional criticism evoked questions regarding course placement practices and their negative impacts on developmental course completion. Of particular concern were inaccurate course placement decisions resulting from the use of standardized placement tests in the course placement decision-making process (Community College Research Center, 2012, November). The combination of questionable course placement practices, and the perception that developmental education programs delay or derail student degree completion, created a condition that warrants further exploration to identify opportunities to remedy the overall student success shortfall within America's community colleges.

This study was intended to explore alternatives to current course placement practices by considering the potential benefits of understanding student traits other than traditional predictors of success, such as standardized test scores. As such, the present research provided a closer look at the connection between students' non-cognitive traits and student success in developmental-level courses. Specific details regarding the study's purpose follow.

Purpose of the Study

Critics of standardized tests, such as the placement tests that community college admissions offices often reference as admission and course placement tools, have increasingly pointed to the inaccuracy of these cognitive measures of college readiness (Community College Research Center, 2012, November). In their working paper for the Community College Research Center (2012, November), authors Hodara, Jaggars, and Karp stated,

> Student performance on standardized placement exams is weakly correlated with success in college-level courses; consequently, when colleges use these exams as the sole instrument of placement, a large proportion of students may be placed into courses for which they are underprepared or overprepared. The tests' poor predictive validity may be due to a number of factors, each of which represents a specific limitation of the typical assessment process. These include: (1) a lack of student preparation for the tests and understanding of the process, (2) a misalignment between the test content and academic curriculum and standards in college courses, and (3) the use of a single measure for placement. (pp. 1-2)

An additional criticism of standardized tests pointed to the lack of understanding among community college practitioners regarding how to use placement tests for student placement into appropriate course levels, and subsequent deficiencies in creating assessment and placement policies (Melguizo, Kosiewicz, Prather, & Bos, 2014).

The scrutiny surrounding traditional course placement practices, paired with the push toward finding assessment approaches that more accurately identify students' course levels to improve success among community college students, served as motivation for community college practitioners to examine students more holistically (Martin, Galentino, & Townsend, 2014). In response to the course placement trends within the community college environment,

practitioners began to glean guidance from research about multiple measures for course placement, including the examination of non-cognitive measures of college readiness that shed light on student characteristics and traits which support college success (Hoover, 2013). Traits such as motivation, self-management, persistence, help-seeking, emotional intelligence, and social support were among those which appear to raise success among students at all course levels (Chapin, 2015; Friedman & Mandel, 2011; Hoover, 2013).

Researchers (Chapin, 2015; Friedman & Mandel, 2011; Hoover, 2013; Martin, Galentino, & Townsend, 2014) argued that a student placed into an academically challenging course was more likely to succeed if the student possessed such traits, but much of the prior research focused on the impact of these traits on student success within four-year institutions. An evaluation of these traits may be the missing piece for achieving the most accurate placement of students into coursework in community colleges to yield the best possible success rates. More specifically, the use of non-cognitive measures may help more adequately place students into mathematics coursework, within which success rates were among the most concerning at community colleges nationwide (Cafarella, 2016; Cox, 2015; Fong, Melguizo, & Prather, 2015).

The purpose of this study was to understand the relationship between student success in developmental math courses and non-cognitive traits measured in the TypeFocus™ Success Factors Questionnaire for students at a two-year community college in the Southeastern United States. The TypeFocus™ Success Factors Questionnaire contains thirty items. Students' responses to these items measure the the presence of ten non-cognitive traits, and two of the non-cognitive traits, "Willing to Compete" and "Goal Persistence", were the focus of this study. A detailed explanation of the instrument is provided in chapter three within this dissertation. For this study, correlational analysis was conducted to determine whether or not students' non-

cognitive traits might connect to and predict developmental mathematics students' course grades. A more in-depth explanation of the research question and related hypothesis follows.

Research Question and Hypothesis

The research question for this study was, "What is the relationship between community college students' non-cognitive traits and success in developmental mathematics coursework?" Of specific concern were the traits "Goal Persistence" and "Willing to Compete", constructs which are defined and described in a subsequent section within this dissertation. The researcher anticipated that student success rates in developmental mathematics courses were higher among students who possessed these two traits than among their counterparts who lacked these two traits. The relationship between the identified traits and success in developmental-level mathematics courses was examined using Kendall's Correlation analysis. The Null Hypothesis for this study was, "There exists no relationship between non-cognitive traits and student success in mathematics coursework." The guiding questions and the study's purpose intended to identify additional useful measures for math course placement within the community college environment, which will potentially allow practitioners in higher education to broaden and fine-tune existing course placement practices. Better understanding the relationship between mathematics course success and the student traits of "Goal Persistence" and "Willing to Compete" provides practitioners the opportunity to augment the use of cognitive predictors of success, such as GPA and test scores, with non-cognitive measures.

Limitations and Delimitations

This study was not intended to examine relationships between non-cognitive measures and success in mathematics courses in conjunction with other demographic attributes, such as gender, age, race/ethnicity, income level, financial aid eligibility, status as a first-generation

college student, or similar demographic variables. Demographic attributes were captured only for the purpose of describing the study's participants. Furthermore, the study was not meant to explore the impact of non-cognitive traits on the success of students within a four-year institution of higher education, as only community college students were chosen as participants in the study.

Mathematics was the academic discipline for which student success was explored for this research; only student success in the first semester of developmental math coursework was included in the statistical analysis for this study. Student success in other academic disciplines and in subsequent math courses were not a focus of this study.

Faculty attributes, such as classroom pedagogy choices, gender, age, race/ethnicity, and years in the teaching profession or higher education environment, were also excluded as variables for the purpose of this research study. Institutional attributes, such as student enrollment size, campus location, percentage of students receiving financial aid, crime statistics, presence of on-campus housing, and similar descriptors, were also excluded as variables during this study. When included, these attributes were provided only for the purpose of describing the site for the present study. Conclusions resulting from this study relate only to students in two-year community colleges, and only with regard to the specific variables of interest identified for this study.

Conceptual Framework

Two theoretical perspectives motivated the conceptual framework for this study. The first perspective was that of non-cognitive traits and the role these traits play in advancing student success. Various terms encapsulate the perspective related to non-cognitive traits, including the theory of Emotional Intelligence, which serves as a foundational theory of non-cognitive traits from which additional theories have grown. Goleman (1995) established a theory of Emotional

Intelligence, stating that Emotional Intelligence broadens a person's ability to reason and make decisions by allowing them to draw from other types of intelligence in addition to traditional intelligence (IQ) and knowledge acquired through education and experience. The central concept underlying this theory is that people possess varying abilities with regard to perceiving, accessing, understanding, and managing emotions, as people hold varying levels of IQ (Goleman, 1995). Among the components of Goleman's (1995) theory are the constructs self-awareness, self-regulation, internal motivation, empathy, and social skills.

After the emergence of the theory of Emotional Intelligence, higher education leaders and researchers extolled the value of considering an individual's non-cognitive abilities, alongside traditional measures of achievement and intelligence, as predictors of academic and career success (Goleman, 1995; Sandoval-Lucero, Maes, & Klingsmith, 2014). A more focused theoretical perspective, Duckworth's (2016) Grit Theory, has also shown to apply within the education field, and holds similarities to the concept of Emotional Intelligence due to its focus on some shared ideas regarding non-cognitive traits. Duckworth (2016) narrowed the focus on non-cognitive traits to look more closely at the trait of perseverance, and one's ability to remain focused on a goal over an extended period of time. Educational researchers have used Duckworth's Grit Scale assessment (Duckworth, 2016) to examine the impact of Grit-related traits on student success and the benefits to helping students strengthen their Grit (Hill, Burrow, & Bronk, 2016; Strayhorn, 2014; Wolters & Hussain, 2015). Although there existed criticisms of Grit Theory (Credé, Tynan, and Harms, 2017), this theory was largely accepted within the education field. Discussed in greater depth later in this dissertation, Grit Theory served as the theoretical perspective related to non-cognitive traits for this study due to the narrower focus it provides as compared to the theory of Emotional Intelligence. The value placed on non-cognitive

traits motivates further exploration of how these traits may apply to course placement decisions within community colleges, where standardized tests alone have traditionally fueled these decisions (Community College Research Center, 2018).

A second theoretical perspective relevant to this study is Chickering and Reisser's theory of psychosocial development that highlights the influence of environmental factors on students' psychosocial development (Patton, Renn, Guido, & Quaye, 2016). Chickering and Reisser (1993) captured student psychosocial development across seven vectors, including one vector described as Developing Purpose, which was particularly relevant to this study. Within this vector, Chickering and Reisser focused on students' identification of career goals, commitment to personal interests and aspirations, and persistence toward identified goals despite obstacles and challenges (Chickering & Reisser, 1993). Chickering and Reisser also identified environmental factors that influence students' psychosocial development, including institutional objectives, institutional size, student-faculty relationships, curriculum, teaching, friendships and student communities, and student development programs and services (Chickering & Reisser, 1993). The psychosocial development theory of Chickering and Reisser deepens the discussion found later in this dissertation about institutional practices regarding non-cognitive measures. Chickering and Reisser's theory serves to draw connections between institutional awareness of students' non-cognitive traits and the potential impact on course placement decisions, curriculum development, and institutional practices designed to address students' psychosocial development.

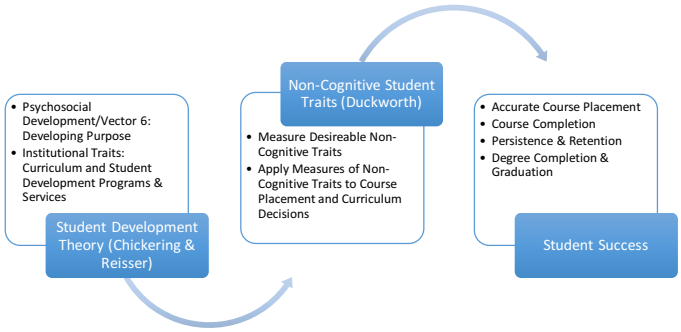

Figure 1. Conceptual framework

Definition of Terms

There are various terms requiring definition for the purpose of this study. The terms and the definition for each are as follows:

- *Student success* was a measure of how well a student met the identified objectives for a course based on the final letter grade assigned to each student. Grades of 'C' or better were considered successful, while all other grades were considered unsuccessful (York Technical College, 2017).
- A *developmental course* was defined as one designed to teach literacy, including the essentials of reading, writing, and arithmetic, and such courses often do not award credit toward an academic degree (Cohen, Brawer, & Kisker, 2013).
- *Developmental-level mathematics courses* were math courses below the Associate's Degree level which serve as preparation for college-level mathematics courses, and cover topics in the areas of arithmetic and pre-algebra primarily per the participating institution's course placement practices (York Technical College, 2017).
- *Goal Persistence* refers to an individual's commitment to a desired outcome or goal (Typefocus, 2018).

- *Willing to Compete* is a measure of an individual's desire to achieve success and the amount of effort the student is willing to exert in order to achieve the desired outcome (Typefocus, 2018).
- *Non-cognitive measures* are factors other than those that measure content knowledge or traditional intelligence, and included such constructs as motivation, self-concept, self-efficacy, realistic self-appraisal, emotional regulation, and other similar traits (Adebayo, 2008).
- *Community college* was defined by Cohen, Brawer, and Kisker (2013) as, "… any not-for-profit institution regionally accredited to award the associate in arts or the associate in science as its highest degree" (p. 5).
- *Community college students* referred to students enrolled in a two-year postsecondary institution in the United States, and encapsulated the diverse demographic backgrounds, academic goals, and learning abilities that are the hallmark of such institutions (Cohen, Brawer, & Kisker, 2013).

Summary

Community college administrators, faculty, and student affairs practitioners are seeking ways to improve outcomes for students in developmental-level and college-level courses. Existing practices have left opportunities for further improvements. One area for further exploration, and the focus of this study, is the development of measures for course placement that utilize information about students' non-cognitive traits instead of students' cognitive abilities alone. The study aimed to examine the research question, "What is the relationship between community college students' non-cognitive traits and success in developmental mathematics coursework?"

CHAPTER II

REVIEW OF THE LITERATURE

Introduction

The purpose of this study was to understand the relationship between student success in developmental mathematics courses and non-cognitive traits that are thought to support students' academic achievement. This inquiry was relevant because community college leaders continue seeking new information to guide decision-making about promising practices for student retention and overall success in the two-year college environment. Since the setting for this study was a community college, this literature review addresses the nature of today's community colleges and common course placement practices in America's community colleges, specifically with regard to student placement into developmental-level mathematics courses. Since these course placement practices have traditionally utilized cognitive measures, a discussion of cognitive traits is also included. Furthermore, the literature review provides a discussion about relevant theoretical perspectives that shed light on college student development and concepts related to non-cognitive traits. The researcher draws connections between these two theoretical perspectives, and reflects on existing research that has begun to reveal a relationship between non-cognitive measures and college student success.

The literature review includes articles, book chapters, reports, briefs, dissertations, and research articles from reputable sources within the fields of higher education, psychology, counseling, and educational leadership. There was an effort to locate recent research articles through peer-reviewed journals relevant to these fields of study and the topics of interest. Sources for the literature review arose through online database searches, including ERIC, Education Full Text, and PsycINFO. Library catalog searches provided books for reference when

appropriate. Search terms, either individually or in combination, included the following and similar terms:

- Community College
- Developmental Studies
- Effectiveness
- Accountability
- Mathematics
- Student Success
- Course Placement
- Non-Cognitive Traits
- Multiple Measures
- Emotional Intelligence
- Grit
- Goal Persistence
- Competitiveness
- Cognitive Measures
- Success Predictors
- Retention
- Standardized Tests
- First-Year Students
- Underprepared Students
- Motivation
- Course Placement

- SAT Predictive Validity
- ACT Predictive Validity
- High School GPA
- Continuing Education
- Non-Credit Programs
- Dual Enrollment
- Dual Credit

The literature review is organized to reflect an overview and history of community colleges, descriptions and criticisms of specific community college programs, course placement practices using cognitive traits in community colleges, non-cognitive traits as predictors of student success, existing research that connects student success predictors with non-cognitive traits among college students, theoretical concepts regarding non-cognitive traits, and relevant student development theory.

History and Current State of Community Colleges

Palmer (2000) accurately described the evolving mission and purpose of the community college across history by stating, "Over the decades, community college leaders and advocates have championed the institution as a cure for large social problems. Their pronouncements mirror the ideals or fears of the times, not to mention ever-shifting legislative agendas" (p. 1). Palmer (2000) further captured the community college mission by describing the current-day shift to focus on workforce development and responsiveness to the employment needs of business and industry. The focus on workforce development within contemporary community colleges was a return to the early commitments of community colleges to provide skilled workers during periods of industrialization early in the twentieth century (Cohen, Brawer, & Kisker,

2013). Over the years, community colleges changed and grew to meet the shifting demands of various constituent groups with a diverse set of needs, though Palmer (2000) explained one consistency:

> But throughout, the community college has remained constant in one important way: it continues to provide instruction at the thirteenth- and fourteenth-grade levels to the citizens of defined, local communities. It therefore acts as the neighborhood school of American higher education, extending the reach of local school districts and connecting them to state university systems. This is what the community college uniquely does. A host of institutions and agencies provides job training and ad hoc adult education. Many other colleges and universities provide undergraduate education to individuals screened through an admissions process. But no other institution has the task of bringing the first two years of college to all citizens of local communities. (p. 1)

Community colleges in the United States were known most commonly as Junior Colleges following their initial inception in 1901 with the opening of Joliet Community College in Joliet, Illinois (Cohen, Brawer, & Kisker, 2013). Over the years since Junior Colleges emerged, these two-year institutions have fulfilled a variety of demands and needs, such as fueling the workforce with skilled laborers during the rise of automated industry in America, training war veterans to seek careers within emerging business and industry, and providing a general education curriculum for students who aspire to attend four-year universities (Cohen, Brawer, & Kisker, 2013).

As the purpose of the colleges transitioned, so did the commonly accepted name for these two-year institutions. Cohen, Brawer, and Kisker (2013) stated, “we define the community college as any not-for profit institution regionally accredited to award the associate in arts or the

associate in science as its highest degree" (p.5). In addition to awarding associate degrees in the arts and sciences, community colleges also award certificates, diplomas, and associate degrees in the applied sciences, also termed as technical fields. For students interested in transferring to four-year institutions, the community college is an avenue for earning transferrable course credits that equate to the first two years of a baccalaureate program, commonly at a lower cost than attending a four-year institution for all four years required for a bachelor's degree (Cohen, Brawer, & Kisker, 2013).

The community college mission has also broadened since the early 1900s. While being responsive to business and industry needs to fuel the workforce with skilled workers, community colleges also offer programs and services in response to the community's civic needs and the personal needs of individual community members. (Cohen, Brawer, & Kisker, 2013). In response to the need for additional programs and services to serve business, industry, and communities, community colleges provide remedial education to students who are not yet ready for college-level work. Examples of additional services and programs include: (a) English as a Second Language (ESL) classes; (b) non-credit special interest or continuing education classes, such as motorcycle safety and basic computer skills; (c) short-term training courses that lead to industry-recognized certifications, such as nursing assistant and computer programming; and (d) dual-enrollment opportunities for high school students to earn college credit (Cohen, Brawer, & Kisker, 2013). This list is not exhaustive, but illustrates the breadth of functions America's community colleges serve presently.

Through the provision of diverse programs and services, community colleges have enrolled a student body that exhibits diversity on many attributes. Cohen, Brawer, and Kisker (2013) explained:

> The community colleges reached out to attract those who were not being served by traditional higher education: those who could not afford the tuition; who could not take the time to attend a college full time; whose racial or ethnic background had constrained them from participating; who had inadequate preparation in the lower schools; whose educational progress had been interrupted by some temporary condition; who had become obsolete in their jobs or had never been trained to work at any job; who needed a connection to obtain any job; who were confined in prisons, physically disabled, or otherwise unable to attend classes on a campus; or who were faced with a need to fill increased leisure time meaningfully. (p. 35)

The Community College Research Center (CCRC) website (2018) reflected data about America's community colleges and the students who attend these two-year institutions. Referencing the National Center for Education Statistics, the CCRC reported that 6.3 million students were enrolled in a community college during Fall 2015, representing 38% of all undergraduate students enrolled across all undergraduate institutions. Of undergraduate students enrolled full time, 24% attended a community college. Community colleges serve a significant percentage of the low-income and minority students attending college. According to the CCRC (2018), 44% of low-income students attended a community college as their first college after high school, compared to only 15% of high-income college students attending community colleges as their first institutions after high school. Furthermore, enrollment data regarding minority students indicated that 56% of Hispanic undergraduates were enrolled at community colleges, along with 44% of black students, during the Fall 2015 semester.

Community colleges are largely open-door institutions that allow students to enroll even if they are underprepared for college-level coursework (Cohen, Brawer, & Kisker, 2013). This

practice ensures access to students who historically might have been unable to attend college due to income, race, academic ability, or other barriers (Cohen, Brawer, & Kisker, 2013), but the open-door nature of community colleges created challenges regarding student persistence and graduation. The CCRC (2018) estimated that 25% of students enrolled in a two-year college during the Fall semester did not re-enroll during the subsequent Spring semester. Of students who enrolled in a community college as first-time, full-time, degree- or certificate-seeking students during Fall 2010, 29.4% graduated within three years. When the data included full-time students who started at a community college in Fall 2010 and completed their degree or certificate at another institution, 54.7% graduated within six years (Community College Research Center, 2018).

Within the community college environment, administrators, faculty, and staff are keenly aware of the challenges surrounding student retention and success, but many well-meaning leaders and change-makers are hard-pressed to implement effective and meaningful solutions. This study was intended to add depth to the body of knowledge related to best practices for mitigating the barriers to the completion agenda among community colleges in the United States and to add greater focus to the broad scope of existing research on this topic. In the 2016 national report entitled *Expectations Meet Reality: The Underprepared Student and Community Colleges,* experts with the Center for Community College Student Engagement (CCCSE) stressed that two-year institutions must alter approaches to admission and course placement so a larger number of developmental-level students will succeed during the remedial experience and progress to graduation. Contributors to the report from CCCSE further explained that an estimated 68% of community college students must enroll in at least one developmental education course, suggesting that a broken system for course placement has served as a threat to success for a

majority of students in the community college sector. Bailey, Jeong, and Cho (2010) echoed this reality in their research, concluding that students who were required to take at least one developmental course, many of whom never enrolled after placing into developmental courses, were less likely than their non-developmental counterparts to successfully graduate.

America's two-year colleges face a significant challenge to yield higher student completion rates amidst the trend that a majority of enrolling students placed into developmental courses, while a significantly low percentage advanced beyond the remedial level (Crisp & Delgado, 2014). In an effort to improve eventual completion rates, there has been a movement among community colleges to adopt new placement techniques that reduce the number of students required to take developmental courses, while also seeking best practices for improving completion and retention rates among students who must still enroll in developmental coursework (Dougherty & Townsend, 2006).

In the Community College Research Center (2012, November) working paper entitled *Improving Developmental Education Assessment and Placement: Lessons from Community Colleges Across the Country*, the authors highlighted several community colleges that used multiple measures as tools for determining students' course placement. This publication reflected the growing desire in community colleges to implement tools to improve the accuracy of course placement to reduce the number of students required to take developmental courses and to improve overall completion rates.

The Community College Research Center (2012, November) described various course placement tools that were in use, including high school courses completed, writing samples, and surveys of non-cognitive factors such as a student's perception of their ability to afford college, their sense of being academically prepared for college, and the availability of support. The goal

of new approaches was to move students more swiftly through developmental-level courses or to allow students to bypass these courses altogether.

Criticisms of Community Colleges

Broad Functions and Program Offerings

In their early history, community colleges held a clearly defined purpose and mission: to provide training opportunities to war veterans and minority populations in order to broaden educational access and fuel the workforce (Cohen, Brawer, & Kisker, 2013). Over time, community college missions broadened, and many critics claimed that the mission grew too vast to yield effective outcomes across all programs (Dougherty & Townsend, 2006). Dougherty and Townsend (2006) described the nature of criticisms regarding the community college mission:

> Questions and concerns about the community college's missions have recurred throughout the institution's history. Often these questions are framed in overly strong dualisms: Is the community college's mission to provide transfer education so that students can eventually attain a baccalaureate, or is it to offer workforce development to meet the needs of business and industry? Should two-year colleges focus on ensuring open access to higher education for all who desire it, or should they concentrate more on providing high-quality academic and occupational training? (p. 5)

Even with criticisms that our two-year institutions held unfocused missions, American community colleges provided to their local communities and to their students a broad set of functions (Cohen, Brawer, & Kisker, 2013). These institutions offered basic skills development through: (a) English as a Second or Other Language classes, (b) General Education Development high school equivalency programs, and Adult High School programs; (c) education to underprepared college students; (d) technical/vocational training; (e) college-transfer coursework

for those wishing to later attend a four-year institution; (f) short-term training opportunities through continuing education offerings; and (g) community colleges have grown vertically to offer college credit to high school students through early- or middle-college dual enrollment options (Cohen, Brawer, & Kisker, 2013). This list is only partially inclusive of the many functions within a community college, and each function encounters questions raised among higher education professionals and community college constituents in the interest of proving effectiveness and demonstrating usefulness (Boggs, 2009). The ongoing push for greater accountability in all areas of U.S. higher education has, as one would expect, stretched community college practitioners to vocalize a renewed case for the value of the diverse set of opportunities available in the two-year college sector (Century Foundation, 2013).

Dual Enrollment

Existing literature regarding community colleges and specific programs within our two-year institutions examined effectiveness, advantages, and disadvantages to various areas of interest. For example, community colleges have worked diligently since the 1980s to develop dual enrollment opportunities for high school students. Dual enrollment was one partnership that community college's forged with K-12 school districts, with the primary desired outcome being a smoother pathway from high school to college for all students choosing dual enrollment opportunities (Palmer, 2000). Dual enrollment programs provided high school students, usually in their Junior or Senior year, with the chance to complete college courses either at their high school or by participating in classroom-based experiences on the college campus (Andrews, 2000; Cohen, Brawer, & Kisker, 2013). Also referred to as dual credit programs, dual enrollment was devised by community colleges in the 1980s in response to public school concerns that their highest performing high school students were finished with all credit requirements for high

school graduation by their twelfth grade year, and they were not challenged to continue advancing academically once they maximized the benefits of a high school education (Andrews, 2000). In more recent years, schools have shifted away from offering dual enrollment options to only high-achieving students and were encouraged to also provide underserved and lower-performing high school students the opportunity as well (Community College Research Center, 2012). Many high schools still required a minimum GPA when identifying students eligible for dual enrollment, but many K-12 districts encouraged that selection occur based on factors other than only GPA (Community College Research Center, 2012). These opportunities for college credit are referred to as "dual credit" when the student earned both high school and college credit for a course or set of courses (Andrews, 2000).

Despite the great effort from college administrators to develop mutually beneficial dual credit programs, criticisms have surfaced regarding various facets of the dual enrollment effort. Taylor (2015) researched the equitability of dual credit programs for high school students of diverse backgrounds, finding that current policies support equal access to dual credit opportunities and subsequent college enrollment, but showed that low-income students and those of color demonstrated subsequent college enrollment and completion at a lower rate than for other student populations. Evidence existed, however, to suggest that dual enrollment students who tended to not perform well in college, such as low-income, low-achieving, and male students, experienced greater gains in subsequent college academic success than other dual enrollment students (Community College Research Center, 2012).

Dual credit programs grew exponentially through the 1980s to today, and were widely viewed as valuable to students and institutions alike (Andrews, 2000). Even though the value of dual credit opportunities for high school students was heralded, dual enrollment program

criticisms included concerns about colleges' abilities to serve multiple K-12 districts at one time, and the absence of formal agreements between school districts and community colleges to secure dual credit for participating students (Cohen, Brawer, & Kisker, 2013).

Though criticisms existed, dual enrollment programs continued to provide a needed benefit to high school students. These students eventually became degree-seeking and dual enrollment programs accelerated the time to degree completion upon post-high school matriculation into higher education institutions (Cohen, Brawer, & Kisker, 2013; Taylor, 2015). The Community College Research Center (CCRC) (2012, February) of the Teachers College at Columbia University reported results of a study reflecting that 67% of student participants in dual enrollment programs went on to enter postsecondary institutions, while only 50% of non-dual enrollment participants entered postsecondary education. Furthermore, the Community College Research Center (2012, February) reported that students who participated in dual enrollment programs during high school went on to enroll in bachelor's degree programs, persist to the second semester, and continue into their second year at a higher rate than those students who did not take advantage of dual enrollment opportunities during high school.

Dual enrollment offerings allowed colleges to prime high school students for future college enrollment post-high school, and colleges benefitted from tuition dollars generated from a segment of the population that traditionally did not yield revenue: high school students who had not yet reached college (Andrews, 2000). High school guidance counselors engaged in the process of identifying dual enrollment participants, so community college recruiters had a captive audience to whom they could promote the value of the college's plethora of educational opportunities. This recruitment tool opened doors that were previously closed, allowing the community colleges to compete slightly more against four-year colleges and universities (Cohen,

Brawer, & Kisker, 2013). The institutional benefits gleaned from dual enrollment programs served as motivation for community colleges to continue forging revised agreements that further advance the agendas of K-12 school districts, high school students, and the community colleges.

Developmental Education

Cohen, Brawer, and Kisker (2013) defined developmental education as a response to the upsurge of underprepared students exiting high schools in the 1980s. It was designed to fill gaps in knowledge and understanding prior to entrance into college-level courses that required a certain knowledge or skill set for student success (Cohen, Brawer, & Kisker, 2013). Developmental-level courses provided skill development to prepare students for curriculum-level courses, and often linked underprepared students to additional resources, such as student success courses and tutoring to support academic success (Boylan & Trawick, 2015). Although the upsurge in remedial enrollment leveled off in the 1990s, the perceived need for developmental education programs persisted (Cohen, Brawer, & Kisker, 2013).

Developmental education successfully created access to higher education for students who may have otherwise been unable to successfully complete a curriculum program (Cohen, Brawer, & Kisker, 2013). Since many students who were academically unprepared for college-level courses also fell into other student populations that were historically underserved in higher education, developmental studies programs allowed greater access for students from lower socio-economic backgrounds and minority students (Cohen, Brawer, & Kisker, 2013). The Community College Research Center (2018) website stated:

> At public two-year colleges, 78 percent of Black students, 75 percent of Hispanic students, and 64 percent of White students take remedial courses. Of students in the

lowest income group, 76 percent take remedial courses, compared with 59 percent in the highest income group. ("Developmental Education at the Community College," para. 2) Sixty-eight percent of students starting their studies at a community college enroll in at least one developmental course (Chen, 2016).

Further criticisms of developmental education programs addressed concerns related to class-based and race-based discrimination in remedial placement practices, the negative impact of remediation programs on student persistence and completion, and overall effectiveness of developmental courses (Cohen, Brawer, & Kisker, 2013; Handel & Williams, 2011). As long as students entered America's community colleges with varied levels of readiness, there existed a need for developmental education programs to bridge the gap between high school preparation and the skills needed for eventual college-level course success (Handel & Williams, 2011).

Efforts to expedite students' progression through remedial pathways via accelerated learning opportunities also fell under criticism. Creating an accelerated remedial pathway was a current-day response to claims that developmental studies programs deter college completion (Hodara & Jaggars, 2014). While accelerated programs yielded positive results for moving students into college-level courses, researchers found that overall success is jeopardized in college-level courses for students who moved too swiftly through the remedial track (Hodara & Jaggars, 2014). In contrast, some strategies suggested that accelerated remedial programs improved a student's time to completion and increased the likelihood that students would enroll in these gatekeeper courses at all (Center for Community College Student Engagement, 2016).

Further suggestions for improving outcomes for underprepared community college students included changes to pedagogy in these classrooms, removal of developmental education courses from the curriculum, and better curriculum alignment between high school courses and

developmental courses as well as between developmental level courses and college-level courses (Center for Community College Student Engagement, 2016). Lacking a proven solution to the developmental education conundrum, community college professionals sought a revision of course placement practices as a possible next step to rectify the challenges associated with remediation in the two-year college sector (Crisp & Delgado, 2014).

Continuing Education

An additional program within today's community college sector is the continuing education initiative. Cohen, Brawer, and Kisker (2013) defined continuing education, using the term lifelong learning, as, "Intermittent education designed for people who have either completed or interrupted their formal studies and who seek to develop their potential or resolve their problems" (pp. 336-337). Continuing education programs typically provided offerings designed for personal interest, advancement to a better occupation, or advancement within one's present occupation through company-sponsored non-credit coursework (D'Amico, Morgan, Robertson, & Houchins, 2014).

Continuing education programs nationwide, also known as non-credit programs, provided the community with basic skills instruction, occupational and workforce training designed to upgrade job skills, and classes for personal interest and lifelong learning. Community colleges often provided these non-credit courses and training options in response to demands that result from governmental initiatives, such as the Workforce Investment Act (WIA) that emerged in the late 1998 through federal legislation to fund large segments of the workforce to learn skills that would lead to employment and re-stabilization of local, state, and national economies (Flynn, 2004). Such governmental programs depended on short-term training and retooling options that allowed students to quickly earn industry-recognized certifications leading to employment in job

fields lacking skilled workers (Flynn, 2004). Since credit-bearing curriculum programs often took longer than desired to complete while meeting these employment and workforce needs, community colleges competed with corporate entities by offering short-term non-credit programs that were supported by funding sources like WIA (Flynn, 2004).

Continuing education programs also played a role in the lives of America's oldest workforce members. Aging Americans remained in their careers and jobs longer than they used to, creating a need for this population to learn new skills and technology to maintain effectiveness in the ever-changing world of work (Cummins, 2014). Non-credit opportunities were often the proper fit for more seasoned workers who wished to update their skills to maintain their roles in the workforce, or for those who retired from a career but wanted to learn skills to work part-time during retirement (Cummins, 2014). Continuing education programs provided for the short-term training needs that curriculum programs within community colleges could not meet.

Businesses and industries reaped benefits of non-credit programs through contract training opportunities, and other agencies enjoyed collaborative efforts as they linked to continuing education programs for services and resources that were otherwise lacking without the partnership (Cohen, Brawer, & Kisker, 2013). Community members from diverse backgrounds enrolled into non-credit courses for a variety of reasons, and demonstrated many attendance and re-enrollment patterns (D'Amico, Morgan, Robertson, & Houchins, 2014). Continuing education accountability measures often connected with revenue earning, institutional responsiveness to business and industry needs, and the extent to which a non-credit program generated skilled workers for specific jobs. One criticism of non-credit programs within community colleges was that a universal course classification system did not exist (D'Amico,

Morgan, Robertson, & Houchins, 2014). The absence of a system for grouping and labeling non-credit courses similarly from one institution to the next made research about course outcomes difficult, primarily because researchers were unable to identify which offerings are similar enough to make comparisons between the many continuing education models in existence (D'Amico, Morgan, Robertson, & Houchins, 2014). Continuing education programs have not been immune to the call for greater accountability that spans all aspects of higher education, however, and new effectiveness measures were among topics for ongoing discussion (Cohen, Brawer, & Kisker, 2013).

Community College Course Placement and Cognitive Traits

Course placement practices in the community college sector transitioned over the years. While placement testing was present starting in the late 1970s and was required in some states' two-year college systems early in the history of America's community colleges, by the year 2000, community college systems in a growing number of states in the United States mandated placement testing as a means to determine student readiness primarily for English, reading, and mathematics courses (Cohen, Brawer, & Kisker, 2013).

With the onset of mandated placement testing came a system for specifying cutoff scores to determine placement level, identifying minimum scores for admission into the institution or certain courses and programs, and creating a delineation between developmental-level and college-level placement (Cohen, Brawer, & Kisker, 2013; Melguizo, Kosiewicz, Prather, & Bos, 2014). This change in approach was largely a response to the pressure for institutions to use data-driven procedures to prove their legitimacy and effectiveness, often with a focus on developmental education and interventions for underprepared students. Placement procedures came under scrutiny, and a history has unfolded that includes a call to action for community

colleges to validate their placement practices (Burdman, 2012; Community College Research Center, 2012, November; Handel & Williams, 2011).

The use of placement testing depended heavily on measuring students' cognitive traits to predict academic success, primarily by measuring content knowledge (Burdman, 2012). For almost as long as community colleges used placement testing procedures, they were called to provide evidence of predictive validity, and proof that there existed a correlation between placement test scores and course grades across a diverse student population (Cohen, Brawer, & Kisker, 2013).

Research supported some correlation between placement test scores and success in college-level math courses, but often pointed to questionable connections between placement test scores and success in developmental-level courses (Burdman, 2012; Cohen, Brawer, & Kisker, 2013; Community College Research Center, 2012, November). In the 2012 paper from the Community College Research Center (2012, November) of the Teachers College of Columbia University, authors Hodara, Jaggars, and Karp stated, "student performance on standardized placement exams is weakly correlated with success in college-level courses; consequently, when colleges use these exams as the sole instrument of placement, a large proportion of students may be placed into courses for which they are underprepared or overprepared" (p. 2).

Additional concerns existed about student success during developmental education and in subsequent college-level courses, and questions arose regarding the impact of low success rates in and following developmental course pathways on the overall success rates at community colleges. Bailey, Jeong, and Cho (2010) reported that only 30-40% of community college students referred to remediation complete the full sequence of developmental education, and many did not enroll in the remedial sequence at all. Handel and Williams (2011) reported that

many students referred to multiple developmental courses based on placement tests never entered the courses into which they placed (Handel & Williams, 2011). These outcomes suggested that requiring students to complete multiple developmental education courses was a detriment to their eventual college completion or successful transfer to bachelor's programs (Chen, 2016). Pairing this reality with concerns about the accuracy of traditional placement tests, when used for decisions about placement into developmental courses, leads one to question why colleges would continue using a placement tool that may not be fully accurate if the identification of a more trustworthy placement method may shorten students' time to degree completion (Burdman, 2012).

In an additional paper sponsored by Achieving the Dream, the Achieving the Dream Developmental Education Initiative and Jobs for the Future, Burdman (2012) espoused the inaccuracy at all levels of course placement using standardized placement tests. Burdman (2012) stated:

> For years, colleges have used placement exams to determine whether to deem incoming students 'college ready' or assign them to developmental education. But emerging information reveals the tests have little correlation to students' future success, casting doubt on their use even as the high stakes for students of taking remedial courses become clear. Educators are rethinking whether the tests are fair and wondering if their traditional use constitutes a barrier to college completion. (p. vii)

Such claims revealed the need for multiple measures as tools for course placement and the need for placement practices which more accurately predict student success in all courses, including mathematics (Ngo & Kwan, 2015). This reality provides an opportunity for further examination of the role non-cognitive traits could play in future mathematics course placement practices.

Non-Cognitive Measures as Predictors of Success

For the purpose of this study, cognitive measures were traits that measured content knowledge and traditional intelligence, such as grade point average and standardized test scores. By contrast, non-cognitive traits were factors that did not measure traditional intelligence or knowledge, but instead measured traits such as motivation, emotional regulation, realistic self-appraisal, self-concept, and self-efficacy (Adebayo, 2008). Non-cognitive measures were believed to help predict student success in college in ways that cognitive measures fell short (Sparkman, Maulding, & Roberts, 2012), but further research may be needed to solidify our understanding of how non-cognitive traits relate to academic success. Gore, Leuwerke, Metz, Brown, and Kelly (2017), for example, discussed the value gained from developing a tool for measuring college students' non-cognitive traits such as social comfort, campus engagement, academic engagement, academic self-efficacy, resiliency, and educational commitment, but concluded that more research was needed regarding the use of these non-cognitive traits as predictors of student success. However, there exists a small body of literature regarding the connection between college student success and the broad concept "non-cognitive measures". Examples of such literature include Savitz-Romer, Rowan-Kenyon, and Fancsali's (2015) discussion of the connection between student achievement and social, emotional, and affective skills referred to as non-cognitive traits. Savitz-Romer, Rowan-Kenyon, and Fancsali (2015) indicated the need for higher education professionals, especially those within student development-oriented programs, to develop mechanisms to assess students' non-cognitive traits as a means to better understand student needs and develop valuable non-cognitive skills to support overall success in college and beyond.

Additional studies were conducted to examine the relationship between college student

success and non-cognitive traits using well-known measures of non-cognitive traits that were frequently noted in the literature. Two frequently-referenced theories related to non-cognitive measures, Emotional Intelligence and Grit, and their connection to college student success are subsequently described in further detail.

Salovey and Mayer (1997) coined and described Emotional Intelligence as, "…the ability to perceive emotions, to access and generate emotions so as to assist thought, to understand emotions and emotional knowledge, and to reflectively regulate emotions so as to promote emotional and intellectual growth" (p. 5). Goleman (1995) established his theory of Emotional Intelligence, which he described in terms of five components: (1) self-awareness, (2) self-regulation, (3) internal motivation, (4) empathy, and (5) social skills. Tools for measuring Emotional Intelligence aimed to measure a variety of traits that connected to these five components. Business and employment sectors increasingly paid more attention to Emotional Intelligence when exploring an individual's potential for success and leadership ability. Often viewed alongside traditional cognitive measures of intelligence (IQ), Emotional Intelligence was believed to add a broader understanding of one's emotional reasoning and decision-making abilities (Goleman, 1995).

Further applications of Emotional Intelligence applied within higher education, with leaders in education pointing to the relevance of Emotional Intelligence to support student persistence and success (Adebayo, 2008; Chapin, 2015; Sparkman, Maulding, & Roberts, 2012). Researchers examined the connection between Emotional Intelligence and college student success with a focus on various student groups and populations. For example, Berenson, Boyles, and Weaver (2008) identified the value of Emotional Intelligence traits in online student success, while Sandoval-Lucero, Maes, and Klingsmith (2014) included in their findings the idea of

aspirational capital, defined as commitment to a goal or vision of the future, as a key factor supporting the success of students of color in the community college environment.

Literature also addressed the use of non-cognitive factors in admissions processes at selective-admission institutions. This literature often focused on identifying alternative admission tools due to concerns about the predictive validity of standardized tests such as the SAT and ACT, which colleges and universities have traditionally employed in the admissions decision-making process (Syverson, 2007). One concept that gained attention was the idea of test-optional admissions, whereby institutions eliminated standardized test scores from the admissions requirements and replaced the tests with written requirements that sought to reveal applicants' perceptions about their fit within the broader academic community, self-esteem with regard to ability to learn, and overall academic and career interests (Syverson, 2007). Soares (2012) discussed the need for admissions practices that were more inclusive to diverse populations, and addressed concerns of bias toward minority groups that existed through the use of standardized tests. Soares (2012) further outlined the use of non-cognitive abilities in the admission process at a university that measured applicants' problem-solving and creative capabilities instead of using SAT or ACT scores, finding that the non-cognitive measure was a more accurate predictor of success than the tests. Studies such as those from Soares (2012) and Syverson (2007) revealed that selective-admission colleges and universities have begun to soften their focus on standardized tests, replacing these tools with other indicators of potential success among applicants. The dialogue about non-cognitive factors as predictors of student success extended beyond college admissions practices at the nation's selective institutions, and included a closer look at students whose academic preparedness was at the lower end of the spectrum: students in remedial and developmental education programs.

In the 2003 article entitled *Social and Emotional Intelligence: Applications for Developmental Education,* Liff explained that traditional intelligence, measured as IQ, accounted for only a portion of a student's potential for success, suggesting that Emotional Intelligence was equally important, if not more important, than traditional IQ as a success predictor. In their study entitled *Community College Student Success: The Role of Motivation and Self-Empowerment*, researchers Martin, Galentino, and Townsend (2014) described their qualitative study of recent community college graduates. The aim of the study was to highlight student traits that facilitated college completion among the students, who participated in interviews. The findings of this inquiry indicated that the graduates held various non-cognitive traits in common, most of which are also components of Emotional Intelligence. Among these traits were clear goals, motivation to succeed, empowerment to solve problems, and the ability to manage external demands that threatened success. The outcomes of such studies serve to support the notion that higher education leaders should be capitalizing on the role of non-cognitive traits, which are commonly viewed as components of Emotional Intelligence, to increase retention and eventual college completion among students (Adebayo, 2008; Berenson, Boyles, & Weaver, 2008; Chapin, 2015; Liff, 2003; Martin, Galentino, and Townsend, 2014; Sandoval-Lucero, Maes, and Klingsmith, 2014; Sparkman, Maulding, & Roberts, 2012).

Closely related to Emotional Intelligence, the concept of Grit emerged in recent years as one which points to factors influencing a person's success academically, professionally, and personally. Duckworth and Gross (2014) discussed traits such as self control, motivation, and grit as key supporters of student success. Grit was defined as a set of skills and abilities that encapsulate individual traits such as self control, self management, delayed gratification, and persistence when a task becomes unpleasant or challenging (Stokas, 2015). Stokas (2015)

explained the connection that grit may have to college student success:

> Because grit has been identified as a quality of high-achieving individuals, it seems to make sense that this particular disposition would be compelling to an educational community concerned with elevating achievement levels and supporting children to push through setbacks and challenges. (p. 514)

Educational researchers explored the connection between grit and success among college students from a diverse set of backgrounds, concluding that the non-cognitive concept of grit accounts for higher levels of success among students from many backgrounds within postsecondary education (Bowman, Hill, Denson, & Bronkema, 2015; Strayhorn, 2014; Wolters & Hussain, 2015).

Professionals within the psychology field also examined connections between grit and a person's potential for success. Psychologists have identified relationships between grit and positive affect, commitment to goals, and overall happiness in life (Hill, Burrow, & Bronk, 2016). A further area of interest within the psychology field has been how grit, defined in this context as persistence, correlates to suicide attempts and non-suicidal self-injury (NSSI). One study with regard to these harmful behaviors indicated that college students with higher levels of grit exhibited self-harm more frequently and with more intensity as their rating on a grit scale increased (Anestis & Selby, 2015). Such studies suggest that persistence as measured by grit scales indicates that individuals will continue working towards a goal, even in situations with the potential for negative consequences such as pain or death. Such persistence is desirable within the context of college students and their drive to achieve academic success.

A plethora of terms exist to describe the non-cognitive traits that are desirable among college students as a support for overall student success. Among these terms are: (a) emotional

intelligence, (b) emotional regulation, (c) motivation, (d) persistence, and (e) self-efficacy. Closely related to these ideas, Duckworth's (2016) theoretical framework of Grit was chosen for the current study because this framework incorporates the combined concepts of passion and perseverance that appear synonymously in the existing body of higher education literature to describe non-cognitive traits believed to facilitate student success. Perseverance and passion toward a specific goal are commonly referenced as non-cognitive traits needed among today's college students, and Duckworth (2016) has coined the term "grit" to describe these two traits occurring in concert with one another. Along with other non-cognitive traits, steps have been made to study grit and determine methods for identifying and measuring the presence of the traits among students (Adebayo, 2008; Graunke, Woosley, & Helms, 2006; Liff, 2003). Grit connects to the instrument used for assessing non-cognitive traits for this study. The TypeFocus™ Success Factors Questionnaire traits chosen for this study were Goal Persistence and Willing to Compete, which are similar concepts to that of Grit. Further explanation of these traits occurs in a subsequent chapter of this dissertation.

Relevant Student Development Theory

Chickering's theory of psychosocial identity development in college students was another lens for this research study due to Chickering's focus on the impact that institutional environment has on student identity development. Chickering identified seven vectors of student development through which students experience individuation (Patton, Renn, Guido, & Quaye, 2016). Chickering's original theory underwent revision in the early 1990s, and the result was that Chickering and Reisser adjusted the seven vectors to their existing form. The seven vectors of student psychosocial development are as follows: (1) Developing Competence, (2) Managing Emotions, (3) Moving Through Autonomy Toward Interdependence, (4) Developing Mature

Interpersonal Relationships, (5) Establishing Identity, (6) Developing Purpose, and (7) Developing Integrity.

One vector is particularly relevant to the specific non-cognitive traits examined during this study, (1) Willing to Compete and (2) Goal Persistence from the Typefocus™ Success Factors Questionnaire. Vector number six, Developing Purpose, deals closely with student goal-setting, persistence toward identified goals, and willingness to work hard for success. In the text *Student Development in College: Theory, Research, and Practice* (2016), Patton, et. al. explained, "this vector consists of developing clear vocational goals, making meaningful commitments to specific personal interests and activities, and establishing strong interpersonal commitments. It includes intentionally making and staying with decisions, even in the face of opposition" (p. 299).

Chickering and Reisser (1993) also suggested that seven environmental influences further impacted student development (Patton, et. al., 2016). The seven key influences are as follows: (1) Institutional Objectives, (2) Institutional Size, (3) Student-Faculty Relationships, (4) Curriculum, (5) Teaching, (6) Friendships and Student Communities, and (7) Student Development Programs and Services (Patton, et. al., 2016). These environmental influences represent the areas in which higher education institutions can exert control over student development and learning, a must-have in today's higher education institutions as college leaders strive to address retention and completion issues (Kuh, et.al., 2005). In their publication *Student Success in College*, Kuh, Kinzie, Schuh, Whitt, and Associates (2005) discussed the need for institutions to have in place environmental factors to influence student outcomes:

> Although not everyone agrees as to the most appropriate way to compute graduation rates, it is clear that increasing persistence and degree completion is a high priority for

> many institutions…Decades of research studies on college-impact and persistence suggest a promising area of emphasis: student engagement. What students *do* during college counts more for what they learn and whether they will persist in college than who they are or even where they go to college. Voluminous research on college student development shows that the time and energy students devote to educationally purposeful activities is the single best predictor of their learning and personal development. (pp. 8-9)

Similarly, Chickering and Reisser (1993) suggested that students enter college with a set of prior experiences which serve as a foundation for further development, and that institutions have the opportunity to influence and direct subsequent development. Of the seven institutional influences, those concerned with curriculum and student development programs and services are most relevant to this study because they address that institutions can impact student development through curriculum choices, and that student development programs are a potential avenue for teaching non-cognitive skills if deemed appropriate for student success in mathematics courses. Further discussion regarding institutional influence and student traits are addressed later in this dissertation.

Summary

The cross-section of literature examined in this review offers support for the value of this study and the potential benefits gleaned from a deeper exploration of the topic. Little research exists to specifically examine the impact of non-cognitive traits on developmental mathematics success among community college students, or the implications for addressing student deficiencies through course placement practices, campus curricula, and student development interventions. Business and education professionals have purported the value of non-cognitive traits, such as those revealed in a review of literature about Emotional Intelligence, Grit, and

similar concepts. Additional literature showcases the need for new approaches to course placement in the community college environment, specifically with regard to developmental studies courses. Therefore, research is needed to better understand how awareness of students' non-cognitive traits can serve higher education practitioners in their decision-making with regard to mathematics course placement and retention strategies to support success. The next chapter in this dissertation outlines the methods employed to thoroughly explore the research questions and attain the stated purpose of this study.

CHAPTER III

METHODOLOGY

Introduction

Community college leaders grapple with the challenges of improving student outcomes and effectively demonstrating the value of a community college education (Boggs, 2009; Community College Research Center, 2005, September). The open access philosophy that guides the community college mission in America means that two-year institutions must continually assess practices and seek to improve those which hinder student retention and success (Rosenbaum, Ahearn, & Rosenbaum, 2016). Since community colleges enroll a diverse student body with varied levels of academic preparation, the question of how best to predict appropriate course placement levels is one that begs further exploration (Rosenbaum, Ahearn, & Rosenbaum, 2016). Additionally, administrators, student affairs practitioners, and classroom faculty often ask how to best support students' academic success (Hodara & Jaggers, 2014). Developmental-level mathematics courses within community colleges are one academic area where improvements in student completion rates would impact overall success indicators, such as graduation and transfer rates (Cafarella, 2016; Cox, 2015).

Community colleges have traditionally used standardized measures, such as placement tests, for determining a student's course placement level (Ngo & Kwon, 2014). Recent practice changes have two-year colleges employing students' high school grade point average (GPA) as a tool for determining student placement levels within community college courses (Ngo & Kwon, 2014). These tools point to cognitive ability and related measures as the determinants of placement level, but competing philosophies suggest that cognitive ability does not fully represent the full picture of a student's success potential. Contemporary ideology suggests that

non-cognitive traits, such as motivation, social support, help-seeking patterns, and emotional resilience also played a role in determining and supporting student success (Burdman, 2012; Community College Research Center, 2012, November).

The purpose of this study was to examine the hypothesis that the student traits of Goal Persistence and Willing to Compete impact student success in developmental-level mathematics courses, and to determine if this relationship between non-cognitive traits and developmental math success indicate a need to assess students' non-cognitive traits as part of the course placement process. This chapter describes the research methodology, and reflects research design, participant selection, study instrumentation, collection of data, data analysis, and a methodological summary.

Research Design

The aim of this study was to explore the relationship between non-cognitive measures and student success in first semester developmental-level mathematics courses in the two-year college environment. A detailed description of the research design follows.

Research Question

The study employed quantitative analysis methods to explore the following question about non-cognitive measures and student success in developmental mathematics:

> What is the relationship between community college students' measures of Goal Persistence and Willing to Compete, and success in developmental mathematics coursework?

The Independent Variables for this non-experimental study were the TypeFocus™ Success Factors Questionnaire ratings for each of the two traits of interest: (a) Goal Persistence and (b)

Willing to Compete. The Dependent Variable for this study was student course grades in developmental mathematics courses.

Non-Experimental research designs are useful when there is no manipulation of an independent variable, and no intervention is applied (Shadish, Cook, & Campbell, 2002). This study used a correlational design to examine the relationship between student grades in first-semester mathematics courses and each of the two student traits known as Goal Persistence and Willing to Compete. The study was not intended to identify causal relationships, but simply to understand the relationship between variables in order to predict future trends and best practices as appropriate. This study examined the relationship between existing variables, and strove to identify any existing correlation between these variables. Further details regarding data analysis are outlined later in this chapter.

Population

The population for this study was students who had enrolled in a community college in the southeastern United States. The population of interest includes students who placed into developmental-level mathematics, and subsequently enrolled in at least one developmental mathematics course.

Sample

Research regarding developmental education indicated that students who were academically underprepared for college carried a unique set of characteristics and challenges not encountered by college-ready students, which may impede persistence and college completion (Crisp & Delgado, 2014). Students who placed into developmental courses experienced difficulty connecting to the academic environment, had unclear goals, and often failed to plan ahead to complete necessary steps for success in college such as registering for classes and

identifying times to participate in tutoring services (Wilmer, 2008). Seeking to describe the relationship between developmental-level students' non-cognitive traits and grades in math courses was of interest due to the need to improve success among developmental students in the community college setting. One potential benefit of this study was to build awareness of the potential value in strengthening the presence of non-cognitive traits among developmental students within the community college environment if these traits are found to support student success.

For participants in this study, course placement level was a product of standardized placement testing that measured cognitive traits commonly referenced as predictors of academic success. All participants for the study were placed into mathematics courses based on scores from the COMPASS placement test. The COMPASS was the placement test in use at the site institution at the time that the sample of students enrolled into the college. As part of the institution's admissions process, each student who was selected as a study participant completed the placement test, which tested students' content understanding in mathematics beginning at the pre-algebra level and extending through the college algebra level. The site institution used already-established cutoff scores for the COMPASS to place students into the appropriate level of mathematics courses, and only students whose test scores placed them into developmental-level mathematics courses were included as participants for the study.

The study included 100 participants selected via convenience sampling, with no random sampling. Convenience sampling occurs when a researcher selects easily accessible, or convenient participants for a study (Salkind, 2007). Convenience sampling was effective and acceptable for this study because any student was eligible for participation if they had completed the TypeFocus™ Success Factors Questionnaire and had enrolled into a mathematics course at

the community college identified as the research site. Furthermore, the use of existing data made convenience sampling a sensible option. The researcher accessed existing TypeFocus™ Success Factors Questionnaire responses to identify potential participants. Only those respondents who had completed the questionnaire during the same semester as or prior to the semester in which they were enrolled into their first mathematics course were identified as study participants. The chosen sampling approach is one of many sampling methods that qualifies as convenience sampling (Salkind, 2007). Table 1 shows participant profiles related to demographic data.

Table 1

Frequency Counts for Participant Gender, Race/Ethnicity, and Age (N=100)

Variable	Frequency
Race/Ethnicity	
Black	35
Hispanic/Latino	8
White	57
Gender	
Female	74
Male	26
Age (years)	
17-20	54
21-30	14
31-40	16
41-50	11
>50	5

The research site was a mid-sized community college in the southeastern United States. Sample participants included current students and students previously enrolled at the institution who had completed the TypeFocus™ Success Factors Questionnaire, the survey instrument

utilized for this study. One institution was invited to participate, and this institution agreed to provide the researcher with student data needed for analysis. Excluded participants were prior and current students at the college who had not completed the TypeFocus™ Success Factors Questionnaire at the participating institution. The researcher also excluded prior and current students who had completed the TypeFocus™ Success Factors Questionnaire at the participating institution, but who had not enrolled into their first mathematics course at the participating institution in a semester subsequent to their completion of the TypeFocus™ Success Factors Questionnaire. Some students in the sample were enrolled in their first mathematics course at the time that they completed the TypeFocus™ Success Factors Questionnaire, and these students were retained as participants. Mathematics courses into which participants enrolled included developmental-level courses that covered basic arithmetic, pre-algebra concepts, measurement and geometry, and data analysis.

The TypeFocus™ Success Factors Questionnaire was one of four questionnaires that comprised the career assessment that the participating institution used as the assessment tool for career guidance activities. The assessment was available to any student of the college at no cost, and was promoted as a career-guidance tool through the institution's website and during classroom presentations by instructors and student affairs personnel. Students who self-identified as being unsure of their chosen career field or academic major were among those who completed the questionnaire, while others completed the questionnaire as a class requirement, or due to their personal desire for self-evaluation.

Instrumentation

TypeFocus™

The TypeFocus™ is an online career assessment tool administered by college and university counselors and advisors, career coaches, high school guidance counselors, employers, and other organizations (TypeFocus, 2018). The TypeFocus™ is broadly adopted for use in career guidance activities with college students across the statewide community college system of which this study's site institution is a member. Dave Wood developed the TypeFocus™ in 1997 to improve career success through self-awareness (TypeFocus, 2018). The TypeFocus™ provides four separate survey instruments: (a) Personality Assessment, (b) Interests Assessment, (c) Values Assessment, (d) Success Factors Questionnaire (TypeFocus, 2018). The Personality Assessment is modeled after the Myers-Briggs Type Indicator (MBTI®) to identify a respondent's personality type; the Interests Assessment items are designed to identify a respondent's career interests; the Values Assessment intends to capture job characteristics, or values, that are a priority to the respondent; and the Success Factors Questionnaire aims to identify the presence of student traits that support the respondent's academic success (TypeFocus, 2018). The present study only utilized participant data from the Success Factors Questionnaire, which is described in greater detail in the next section.

Success Factors Questionnaire Overview

The instrument for this study was the TypeFocus™ Success Factors Questionnaire (SFQ), which presents questionnaire items to assess strengths around non-cognitive measures which support student success. The questionnaire instructions ask respondents to answer each question based on their initial instincts when reading the question, and assures participants that there are no right or wrong responses.

Success Factors Questionnaire Reliability and Validity

The reliability and validity of the TypeFocus™ Success Factors Questionnaire was closely examined prior to study implementation. Of particular interest were content validity, measurement model validity, and internal consistency reliability. An explanation follows regarding the steps taken to establish reliability and validity for the instrument prior to the study.

To ensure content validity, the instrument's creator consulted with career and student success professionals during the development of each questionnaire item to determine if the items measured the intended traits and bore relevance in determining a respondent's rating for each trait. Adjustments were made based on feedback from these professionals, thus establishing content validity for the two subscales, Willing to Compete and Goal Persistence.

A deeper analysis of the instrument's measurement model validity was necessary using Confirmatory Factor Analysis, particularly for the two subscales of interest, Willing to Compete and Goal Persistence. Since factor analysis holds assumptions regarding the normality of a dataset, the skew and kurtosis were calculated for a sample set of data from the TypeFocus™ Success Factors Questionnaire (Statistics Solutions, 2018). After determining that skew and kurtosis were appropriate for the sample set of data, a Confirmatory Factor Analysis was conducted using M+ to determine the validity of the two subscales of interest, Willing to Compete and Goal Persistence. The Confirmatory Factor Analysis demonstrated a fit for the items on these two subscales, indicating validity of the instrument on these two subscales.

Another area of interest was the instrument's reliability. Although there are various types of reliability, a focus was placed on internal consistency reliability. According to Salkind (2011), internal consistency reliability indicates that items on a test or instrument align with one another and only measure one construct. In order to establish internal consistency reliability, Cronbach's Alpha was conducted using M+ on a sample set of data from the TypeFocus™ Success Factors

Questionnaire. Results of this analysis indicated internal consistency reliability on a 0.7 level when the related items were mapped to the two subscales of interest, Willing to Compete and Goal Persistence. The 0.7 level is slightly lower than normally desired, but is explained by the existence of only three questionnaire items per scale (Salkind, 2011). A stronger level may be expected with more questionnaire items for each scale, but 0.7 is acceptable for the number of items per scale within this instrument.

Success Factors Questionnaire Content

The Success Factors Questionnaire (SFQ) is comprised of 39 items that are presented one at a time to the respondent through the internet-based TypeFocus™ platform. The first section of the questionnaire contains nine items that gather the following information about the respondent: (a) academic major, (b) high school GPA, (c) anticipated college completion month and year, (d) parents' level of college degree attainment, (e) confidence rating for chosen academic major, (f) clarity of career goal, (g) number of hours per week spent in employment, (h) number of hours per week spent in family commitments, and (i) number of hours per week spent in other non-academic commitments.

The remaining thirty questionnaire items are statements to which respondents choose likert-type response options as follows: "Strongly Disagree", "Disagree", "Neutral", "Agree", and "Strongly Agree". Each of the 30 SFQ items connects to one of the ten non-cognitive traits that the TypeFocus™ SFQ measures. For example, one item is the statement, "When I start something I finish it", which is is one of three items designed to measure the trait Goal Persistence. Each trait's rating is derived from the participant's responses to three unique questionnaire items. The TypeFocus™ SFQ takes respondents approximately ten to fifteen minutes to complete. The specific traits of interest for this study were Goal Persistence and

Willing and Compete. Figure 2 reflects the Questionnaire items which assessed each of these traits.

Trait	Related Questionnaire Items
Goal Persistence	"When I start something I finish it." "I will work hard to complete my educational goals." "I am committed to completing my studies."
Willing to Compete	"If need be, I will work through the night to get a good grade." "I am willing to compete for good grades." "When it comes to grades, I have a competitive attitude. I want to win."

Figure 2. TypeFocus™ Success Factors Questionnaire items and related student traits

Success Factors Questionnaire Results

The online tool generates immediate results, which are presented using a star rating system (1-5 stars) and a narrative explanation regarding results for each trait. Both the star rating and narrative explanation are accessible to the respondent, and are accessible to college personnel as well. The narrative output reflects the respondent's rating on each trait (from "very low", or one star, to "very high", indicated by five stars). Additional output lists the questionnaire items used to generate a result for the specific trait, comments regarding the benefits of having or developing the trait, and results-specific recommendations.

Data Collection Procedures

Prior to data collection, the researcher discussed methodology with those who control access to student data at the participating institution, and received letters of approval as needed (Appendix A). The participating institution approved the study, and the Institutional Review Board (IRB) at Clemson University granted approval for the researcher to fully implement the study.

In collaboration with the participating institution, the researcher agreed to export TypeFocus™ data from the online tool into a spreadsheet format, match respondent-provided identifying information from the TypeFocus™ to each participant's college-provided unique identifying number, and utilize the identifying number to gather additional information. The data extracted from the TypeFocus™ included each student's name, the date each student completed the TypeFocus™, and the star rating (1-5) for each trait of interest.

Institution personnel extracted additional data from the college's student information system and placed into spreadsheet format. The additional data included the following for each participant: (1) date of birth, (2) race/ethnicity, (3) gender, (4) standardized test scores used for mathematics course placement, (5) mathematics courses completed at the institution, (6) final course grades that correspond to each mathematics course completed at the institution, and (7) semester in which each mathematics course was completed. Participant confidentiality was upheld by using the participating institution's unique identifier (college ID number) for each student once all data were extracted from the TypeFocus™ and matched with data extracted from the student information system. Student names were excluded from the resulting dataset, and results were reported only in the aggregate.

Data were displayed on a spreadsheet which was secured through the institution's password-protected, cloud-based system. Only the researcher had access to the spreadsheet once

it was extracted from TypeFocus™ and the college's student information system, as the data were stored on a password protected computer in a locked office location.

Data used for analysis were students' star rating, on a scale of 1-5, for the two traits of interest in the TypeFocus™ Success Factors Questionnaire, and students' final course grades in their first developmental mathematics course enrolled at the participating institution. The first developmental mathematics course completed by each participating student was identified through examining students' course histories. The date of course completion was then compared to the date each student completed the TypeFocus™ Success Factors Questionnaire to ensure that each student's first developmental mathematics course was completed after completion of the questionnaire. Students were excluded as participants for data analysis if their TypeFocus™ Success Factors Questionnaire responses were captured after their first developmental mathematics course was completed. This step ensured that the rating of the non-cognitive traits of interest, Willing to Compete and Goal Persistence, were captured prior to the conclusion of the identified mathematics course. Students who completed their first developmental mathematics course at the institution during the same semester that they completed the TypeFocus™ SFQ were also included as participants.

Standardized test scores from the COMPASS Placement Test served to confirm students' mathematics course placement level as developmental. Only students who placed into developmental-level mathematics courses were identified as participants in this study. Statistical analyses tested the correlation between letter grade earned in each participant's first semester of developmental mathematics, and ratings for each non-cognitive trait from the TypeFocus™ Success Factors Questionnaire.

Ex post facto data collection included a review of each student's Success Factors Questionnaire rating on a scale of 1-5 (Very Low to Very High) for both of the two traits of interest; mathematics course placement level based on standardized placement test scores (COMPASS); and the final course grade in each student's first developmental mathematics course taken at the institution. The Success Factors Questionnaire ratings were gathered from the TypeFocus™ online tool using Administrator access, then exported to an external spreadsheet for sorting and organizing. Mathematics course placement levels and final course grades were collected from the college's student information system. The researcher included additional demographic data in order to accurately describe the participants. The additional demographic variables included gender, age, and race/ethnicity.

Data Analysis

Data were analyzed using SPSS. The following quantitative methods were employed to analyze the collected data: (1) Demographic statistics and (2) Kendall Rank Correlation Analysis.

Demographic Statistics

The researcher conducted descriptive analyses of the data related to both traits of interest from the TypeFocus™ Success Factors Questionnaire: (a) Willing to Compete and (b) Goal Persistence. Demographic descriptions of the sample resulted from data analysis reflecting frequencies and percentages regarding gender, age range, and race/ethnicity.

Kendall Rank Correlation Analysis

This study was intended to explore the relationship between community college students' non-cognitive traits and course grades in developmental mathematics. In order to explore this correlation, the researcher conducted Kendall Rank Correlation analysis to examine whether or

not participant ratings on the Willing to Compete and Goal Persistence scales correlated with final course grades in first-semester developmental-level mathematics courses. The Kendall Rank Correlation is used to evaluate, "the degree of similarity between two sets of ranks given to the same set of objects" (Salkind, 2007, p. 508). The Kendall Rank Correlation is appropriate for use with data that are measured on an ordinal or continuous scale. Kendall Rank Correlation analysis was appropriate for this study because the dependent variable, grades in mathematics courses, was measured on an ordinal scale, with letter grades assigned a numerical value between 1-5. The non-cognitive traits were independent variables that were also ordinal in nature, reflecting ratings on a scale of 1-5. Besides the assumption that the data are on an ordinal scale, the only additional assumption for use of this analysis is that there is a monotonic relationship between the variables. The Kendall Rank Correlation is used to measure whether or not a monotonic relationship exists between variables, but the monotonic relationship is not a strict assumption for use of the Kendall Rank Correlation (Lund Research Ltd, 2018).

Students who withdrew with a grade of 'W' from a course prior to its completion were excluded from this study since a grade of 'W' did not factor into a student's grade point average. Students who earned grades of 'A', 'B', 'C', 'D', 'F', or 'WF' were included in the study because each of these grading outcomes was included in the students' grade point average calculations. Decisions regarding inclusion or exclusion of participants, based on final course grades earned, were made in alignment with grade point average calculation practices in place at the institution at the time of the study (York Technical College, 2017). The researcher assigned a score of 5 to grades of 'A', a score of 4 to grades of 'B', a score of 3 to grades of 'C', a score of 2 to grades of 'D', and a score of 1 to grades of 'F' and 'WF', aligning with the practices for

weighting grades in grade point average calculation at the participating institution (York Technical College, 2017).

Examination of the data lead the researcher to select the Kendall Rank Correlation because the data were ordinal in nature, and the assumptions of various other tests for correlation were violated (Winship & Mare, 1984). Due to all variables being measured on an ordinal scale, none of the data were able to be checked for normality. Additionally, the relationships between variables were non-linear and non-monotonic. For these reasons, a non-parametric test was needed, and the Kendall Rank Correlation provided the least restrictive set of assumptions.

The researcher conducted data analysis in SPSS to include descriptive statistics, and the Kendall Rank Correlation. G*Power was used to conduct an a priori power analysis. Power analysis is important for determining an adequate sample size, and a study's power refers to the likelihood of rejecting a false null hypothesis (Faul, Erdfelder, Buchner, & Lang, 2009). The power for this study was set at 95%, which is considered sufficient for adequately rejecting a false null hypothesis. For the power analysis, the alpha (α) level was set at .05. The alpha level refers to the probability of rejecting a true null hypothesis, and is commonly set at the .05 level, so this level was selected for the present study (Salkind, 2011). Effect size also plays a role in power analysis, and refers to the measure of the strength of a relationship between variables (Salkind, 2011). A medium effect size was selected for the power analysis so that the effect size would not be overly strict or too lenient. Finally, the power analysis also depends on the directionality of the test. The researcher conducted the power analysis based on a two-tailed test. Based on the chosen alpha, effect size, and power, the results of the power analysis suggested that a sample of 47 participants was necessary to adequately measure the variables of interest for the study. The researcher included 100 participants (N=100) for the study, so the sample size was

greater than the suggested sample size resulting from the power analysis, and was deemed sufficient for measuring the relationship between the dependent and independent variables.

Summary

This study examined the relationship between two separate non-cognitive traits and student course grades in first-semester developmental-level mathematics courses within a community college. The researcher utilized existing data from student responses to an online instrument that measured non-cognitive traits, and conducted statistical analysis to examine the relationship between course grades in the specified mathematics courses, and each of two pre-identified traits. Course grade data were provided by personnel at the participating institution.

The researcher conducted data analysis in SPSS to include descriptive statistics and the Kendall Rank Correlation, and used G*Power to conduct an a priori power analysis. Sample size was determined by the results of the power analysis, and the additional data analysis in SPSS allowed the researcher to determine whether to accept or reject the Null Hypothesis. Detailed findings are outlined in the next chapter of this dissertation.

CHAPTER IV

PRESENTATION OF FINDINGS

Introduction

This chapter outlines the study and its findings. The study was intended to better understand the relationship between non-cognitive traits and student success in developmental mathematics courses among community college students by exploring the research question, "What is the relationship between community college students' non-cognitive traits and success in developmental mathematics coursework?". The researcher identified a sample of 100 developmental-level math students who had completed an instrument that measured non-cognitive traits. Kendall Rank Correlation analysis was conducted to explore the relationships between the students' course grades and student ratings on two measures of non-cognitive traits, Willing to Compete and Goal Persistence. An initial discussion of the study's purpose, research question, hypothesis, and variables of interest is followed by a description of the study's participants. Finally, the correlational data is presented, along with overall findings from the study.

Research Question and Hypothesis

The primary purpose of the current study was to explore the relationship between non-cognitive traits and student success in developmental mathematics courses. The research question that guided the study was, "What is the relationship between community college students' non-cognitive traits and success in developmental mathematics coursework?" The Null Hypothesis was, "There exists no relationship between non-cognitive traits and student success in mathematics coursework."

The independent variables were students' ratings on the TypeFocus™ Success Factors Questionnaire for two traits of interest: (1) Goal Persistence and (2) Willing to Compete. The dependent variable for the study was the set of student grades in developmental mathematics courses. The researcher examined the research question and made decisions regarding acceptance and rejection of the null hypothesis by conducting Kendall's Rank Correlation analysis to identify the relationship between each of the two independent variables and students' course grades in developmental math. The results of the data analysis and the study's findings are outlined in detail following a detailed description of the study's participants, including demographic data.

Sample

The sample for the present study consisted of 100 students from a mid-sized community college in the southeastern United States. The participants were selected from among students who had completed the TypeFocus™ Success Factors Questionnaire at the institution identified as the study site. In addition to having completed the TypeFocus™ Success Factors Questionnaire, participants also placed into developmental-level mathematics based on standardized placement test scores, and completed their first semester of developmental mathematics coursework during the semester in which they completed the TypeFocus™ Success Factors Questionnaire or in a subsequent semester.

The sample (N=100) consisted of 26% males and 74% females. The sample also consisted of a racially and ethnically diverse set of students: 57% of the sample consisted of students who identified as White; 35% identified as Black; and 8% identified as Hispanic/Latino. The participants' ages approximately represented those typically expected within America's community colleges, with 54% of the participants falling within the range of 17-20 years of age

(Cohen, Brawer, & Kisker, 2014). The ages of the remaining participants fell into the following ranges: 14% were age 21-30; 16% were age 31-40; 11% were age 41-50; and 5% were over 50 years of age. The median participant age was 19.5 years, and the mean age was 26.77 (*SD* = 11.21, Skewness = 1.124, Kurtosis = .108). See Table 1 for demographic data for the sample.

Based on standardized placement test scores, participants placed into one of two developmental-level mathematics courses: 49% of the participants enrolled into MAT 031 (Developmental Math I) and 51% of the participants enrolled into MAT 032 (Developmental Math II). The study participants completed the TypeFocus™ Success Factors Questionnaire and enrolled into their first mathematics course between Summer semester 2013 beginning in May 2013, and Spring semester 2017 beginning in January 2017. For each of the developmental mathematics courses, instruction was offered over a sixteen-week semester. Although the site institution offers developmental mathematics courses in a shorter eight-week instructional session, the course sections completed by participants in the present study met over a full sixteen-week semester. Developmental mathematics courses met either two days per week for one hour and fifteen minutes each class session or three days per week for 50 minutes each class session. Since class instructional time was not a focus of the study, information has been excluded regarding the number of study participants enrolled in two-day versus three-day per week course sections.

Table 2 represents participants' final course grades in first-semester developmental mathematics courses. The mean grade for all participants from both developmental mathematics courses (MAT 031 and MAT 032 combined) was a C. When participants' grades were separated by course, the mean grade was a C for those who completed MAT 031 (*N=49),* and the mean grade was a C for those who completed MAT 032 (*N=51)*.

Table 2

Frequency Counts for Participant Final Grades in Developmental Mathematics Courses (N=100)

Variable	Frequency
MAT 031 Grade	
A	9
B	19
C	19
D	1
F	0
WF	1
MAT 032 Grade	
A	15
B	16
C	13
D	5
F	2
WF	0

Table 3 below represents participant ratings on the Willing to Compete and Goal Persistence scales from the TypeFocus™ Success Factors Questionnaire. Ratings on the Goal Persistence scale had a range between 3-5, and the mean rating was 4.40 (*SD* = .93, Skewness = -.160, Kurtosis = -1.16). Ratings on the Willing to Compete scale ranged between 2-5, and the mean rating was 3.89 (*SD* = .71, Skewness = -.758, Kurtosis = -.666).

Table 3

Frequency Counts for Participant Ratings on TypeFocus™ Success Factors Questionnaire (N=100)

Variable	Frequency
Goal Persistence Rating	
1	0
2	0
3	13
4	34
5	53
Willing to Compete Rating	
1	0
2	5
3	35
4	28
5	32

Analysis of the Research Question

The correlations between the dependent variable, developmental mathematics course grades, and each of the two independent variables, participant ratings on Willing to Compete and on the Goal Persistence scales from the TypeFocus™ Success Factors Questionnaire, were determined using Kendall Rank Correlation analysis. Kendall Rank Correlation was appropriate because this type of analysis, "evaluates the degree of similarity between two sets of ranks given to the same set of objects" (Salkind, 2007, p. 508). Furthermore, the variables were ordinal, and Kendall Rank Correlation is useful for analyzing ordinal data. Participants' course grades, the dependent variable, were ranked using the following scale: A=5, B=4, C=3, D=2, F=1. Participants' ratings on the Willing to Compete and Goal Persistence scales from the TypeFocus™ Success Factors Questionnaire were reported on a scale of 1-5, with 1 being the lowest possible rating and 5 being the highest possible rating on each trait.

Kendall Rank Correlation analysis was conducted to determine the relationship between each participant's Willing to Compete rating and course grade, and then a separate Kendall Rank Correlation analysis was conducted to determine the relationship between each participant's Goal Persistence rating and course grade. In addition to conducting analysis of all participant data in the aggregate, the analysis was also conducted on the subset of students who completed MAT 031, and separately the data were analyzed for the subset of students who completed MAT 032. This additional step of separating students based on completed developmental mathematics course was taken to detect any possible relationship between dependent variable and independent variables at the course level, versus only examining developmental mathematics student data collectively.

Table 4 shows the results of the data analysis. The results indicate that there exists no significant relationship between student grades in all developmental mathematics courses and either of the non-cognitive traits of interest. When separated and analyzed by developmental mathematics course, the results indicate that there exists no significant relationship between student grades in MAT 031 and either of the non-cognitive traits of interest, and there exists no significant relationship between students grades in MAT 032 and either of the non-cognitive traits of interest.

Table 4

Kendall Rank Correlations for Mathematics Course Grades and Ratings on TypeFocus™ Success Factors Questionnaire

Course/Trait	Kendall's Tau-b	Sig.
All Courses		
x Willing to Compete	.156	.090
x Goal Persistence	.053	.552
MAT 031 Course		
x Willing to Compete	.106	.401
x Goal Persistence	.046	.725
MAT 032 Course		
x Willing to Compete	.186	.122
x Goal Persistence	.067	.587

*$p < .05$ **$p < .01$

Summary

Participants for the present study were chosen from a population of developmental mathematics students who completed the TypeFocus™ Success Factors Questionnaire. Convenience sampling was used to identify a sample of students who enrolled into their first mathematics course at the site institution subsequent to completion of the TypeFocus™ Success Factors Questionnaire between May 2013 (Summer 2013 semester) and January 2017 (Spring 2017 semester). The 100 participants enrolled into developmental mathematics courses (MAT 031 and MAT 032) based on standardized placement test scores with approximately half of the sample in each of the two courses. The sample for the study was representative of the population

of interest as related to age, gender, and race/ethnicity. Kendall Rank Correlation analysis was was conducted on the dependent variable, mathematics course grades, and the two independent variables, Willing to Compete ratings and Goal Persistence ratings. Statistical analysis in SPSS resulted in the researcher accepting the Null Hypothesis because the Kendall Rank Correlation indicated that no relationship existed between the dependent variable and each independent variable.

CHAPTER V

DISCUSSION

Introduction

Community college personnel continue to explore strategies to improve overall student success in an effort to demonstrate the value of college enrollment at a two-year institution (Boggs, 2009; Community College Research Center, 2005, September). One area of concern is the impact of remedial education on overall student success (Chen, 2016). For example, Burdman (2012) reflected on the lack of evidence that developmental education was effective, the role that traditional standardized placement tests played in inaccurate course placement decisions, and the need for alternatives to existing course placement practices to provide more accurate student placement. As such, college leaders are seeking possible innovations for improving success in developmental-level courses to promote student progression through course pathways to graduation or successful college transfer (Handel & Williams, 2011).

The present study addresses developmental mathematics specifically, and aims to understand the relationship between student grades in remedial mathematics courses and students' non-cognitive traits as measured by the TypeFocus™ Success Factors Questionnaire. The purpose of this study was to understand the possible role that a measure of non-cognitive traits may play in predicting student success in developmental mathematics courses. Additional discussion in this chapter focuses on the potential for improving mathematics course placement practices and subsequent student success in developmental mathematics courses through the use of non-cognitive measures when placing students into developmental-level courses.

Review of Current Literature

One intervention explored within the literature was a possible change to course placement practices to address criticisms that cognitive measures such as standardized placement tests were not always accurate predictors of college student success (Burdman, 2012; Ngo & Kwan, 2015). Ngo and Kwan (2015) indicated that developmental mathematics students benefit from college use of multiple measures to predict student success and place them into appropriate course levels, including the possible use of non-cognitive measures to enhance course placement accuracy.

When exploring effective course placement practices, non-cognitive traits are of interest to higher education practitioners because of the existing evidence suggesting that a person's non-cognitive traits, such as persistence, motivation, self-efficacy, and emotional regulation, serve to support overall academic and career success (Hoover, 2013). Although several theories of non-cognitive traits exist, Duckworth's (2016) Grit Theory served as the theoretical framework related to non-cognitive traits for this study. Grit Theory suggests that a person who possesses a sense of persistence and passion toward a goal will experience greater success outcomes. Research on Grit Theory supports this notion, indicating that those with Grit demonstrate success in areas such as academic and career pursuits (Duckworth & Gross, 2014; Stokas, 2015; Strayhorn, 2014; Wolters & Hussain, 2015). Since unsatisfactory student success rates in remedial mathematics coursework is an area of concern for community colleges, this correlational study aimed to explore the relationship between students' developmental-level mathematics course grades and a measure of students' non-cognitive traits.

A secondary aim of the study was to explore the relevance of measuring students' non-cognitive traits as a predictor of success in developmental mathematics courses. An additional motivation for exploring this correlation was the concern that traditional standardized tests are

not valid predictors of college student success, but have served as the tool for course placement decisions within America's community colleges for decades (Burdman, 2012; Melguizo, Kosiewicz, Prather, & Bos, 2014). Thus, an additional guiding question for the study was whether or not a measure of non-cognitive traits may be more valid in predicting student success than the traditional cognitive measures, such as standardized tests.

Another theoretical framework for the study was Chickering and Reisser's (1993) theory of psychosocial development in college students, which addresses seven vectors of student development and environmental factors that influence student development. The vector of particular interest for this study was vector six, Developing Purpose, due to its focus on student goal-setting, striving to accomplish stated goals, and persistence through challenges to success (Patton, et. al., 2016). The component of Chickering and Reisser's (1993) theory that addresses environmental factors is relevant to the present study because it points to the need for institutional leaders to thoughtfully consider how student engagement structures can best support student retention and completion, an issue of particular interest within today's community colleges where retention and completion rates are of concern (Century Foundation, 2013; Community College Research Center, 2005, September; Crisp & Delgado, 2014). A later section of this chapter addresses the link between the study's findings and interventions within community colleges to impact student outcomes.

To achieve the purpose of this study and identify implications for community college practitioners and decision makers, the Kendall Rank Correlation analysis was used to analyze the relationship between participants' course grades and their scores from the TypeFocus™ Success Factors Questionnaire. The TypeFocus™ Success Factors Questionnaire measures various non-cognitive traits, including the two chosen for this study: (1) Willing to Compete and (2) Goal

Persistence. Implications for course placement practices are one consideration regarding the study's findings and possible impacts on college student success within developmental mathematics. The findings of this correlational study are outlined in the next section.

Summary of Research Findings

The research question for this study was, "What is the relationship between community college students' non-cognitive traits and success in developmental mathematics coursework?" The Null Hypothesis for the study was, "There is no relationship between community college students' non-cognitive traits and success in developmental mathematics coursework." The research question was explored through a correlational study in which student data was analyzed using Kendall Rank Correlation analysis. The data of interest were student course grades for two developmental mathematics courses and student ratings for the traits Willing to Compete and Goal Persistence on the TypeFocus™ Success Factors Questionnaire.

Initially, the statistical analysis was conducted on student course grades for all participants, regardless of whether they completed MAT 031 or MAT 032, with all participant data combined together. Kendall Rank Correlation analysis on mathematics course grades and Willing to Compete scores yielded $r = .156$ ($p > .05$), and analysis on mathematics course grades and Goal Persistence scores yielded $r = .053$ ($p > .05$). These results indicate that there is no significant relationship between participants' developmental mathematics course grades and each of the scores for the non-cognitive traits of interest, so the null hypothesis was accepted for both non-cognitive traits included in this analysis.

To explore the relationship between the non-cognitive traits of interest and developmental-level mathematics course grades more thoroughly, the participants were separated into subgroups based on mathematics course completed, either MAT 031 (Developmental

Mathematics I) or MAT 032 (Developmental Mathematics II). The Kendall Rank Correlation analysis was then conducted to examine the relationship between the students' course grades in MAT 031 and the MAT 031 students' scores on the TypeFocus™ Success Factors Questionnaire. Kendall Rank Correlation analysis on MAT 031 participants' course grades and Willing to Compete scores yielded $r = .106$ ($p > .05$), and analysis on mathematics course grades and Goal Persistence scores yielded $r = .046$ ($p > .05$). These results indicate that there is no significant relationship between MAT 031 participants' course grades and each of the scores for the non-cognitive traits of interest, so the null hypothesis was again accepted for this analysis.

Next, the Kendall Rank Correlation analysis was conducted to examine the relationship between the students' course grades in MAT 032 and the MAT 032 students' scores on the TypeFocus™ Success Factors Questionnaire. Kendall Rank Correlation analysis on MAT 032 participants' course grades and Willing to Compete scores yielded $r = .186$ ($p > .05$), and analysis on mathematics course grades and Goal Persistence scores yielded $r = .067$ ($p > .05$). These results indicate that there is no significant relationship between MAT 032 participants' course grades and each of the scores for the non-cognitive traits of interest, so the null hypothesis was accepted once more for this subset of participants.

The study found that student scores on the Willing to Compete scale and the Goal Persistence scale from the TypeFocus™ Success Factors Questionnaire are not significant predictors of student success in developmental mathematics courses at the site institution.

Discussion

Prior literature regarding the relationship between individuals' non-cognitive traits and success suggested those who possess traits such as persistence, self-efficacy, motivation, and emotional regulation were more likely to experience academic and career success (Berenson,

Boyles, & Weaver, 2008; Chapin, 2015; Friedman & Mandel, 2011). Employment hiring managers, psychologists, and educators each reported a greater likelihood of career and academic success among employees and students who possessed these non-cognitive traits, often referred to as Emotional Intelligence or Grit (Bowman, Hill, Benson, & Bronkema, 2015; Harvard Business Review, 2015; Rimfeld, Kovas, Dale, & Plomin, 2016; Sparkman, Maulding, & Roberts, 2012). Based on the prior literature, this researcher's hypothesis was that there would exist a relationship between developmental mathematics course grades in a community college and students' ratings on an instrument that measures non-cognitive traits, the TypeFocus™ Success Factors Questionnaire. Of specific interest were the TypeFocus™ Success Factors Questionnaire traits Goal Persistence and Willing to Compete, constructs which appeared to the researcher to closely mirror other well-researched constructs measured by the Grit Scale and similar measures of Emotional Intelligence (Duckworth, 2016; Goleman, 1995).

The present research study findings indicate that there exists no relationship between students' TypeFocus™ Success Factors Questionnaire Willing to Compete and Goal Persistence ratings and their developmental mathematics course grades. These findings contradict similar research conducted previously about college student success and non-cognitive traits. For example, Strayhorn (2014) reported that the presence of Grit among Black male students in a predominately White institution held greater predictive validity than traditional predictors of student success, such as high school GPA and standardized test scores. In another study, Sparkman, Maulding, and Roberts (2012) found that certain components of Emotional Intelligence, such as impulse control and social responsibility, were strong predictors of academic success among a sample of traditional college-aged Freshmen at a four-year institution. Graunke, Woosley, and Helms (2006) supported the notion that a student's commitment to a goal

predicted that they would successfully graduate with a Bachelor's Degree from a four-year college, reflecting the predictive validity of a construct similar to the concept of Goal Persistence measured in the present study.

Despite prior research supporting that non-cognitive traits among college students correlate to academic success, a similar correlation was not evident in this dissertation study. When compared and contrasted to prior studies, however, the present study held many differences that may account for the findings. One important difference is that the majority of research regarding the role of non-cognitive traits as predictors of student success was conducted at four-year colleges and universities, while the current study occurred at a community college. Furthermore, the focus of this dissertation study was narrow when compared to many prior studies, with a specific aim of understanding how non-cognitive traits may predict student success in developmental mathematics courses. By contrast, previous studies supporting the correlation in question focused on student success indicators such as Fall-to-Spring semester persistence rates, Fall-to-Fall retention rates, students' GPA, and graduation rates (Bowman, Hill, Benson, & Bronkema, 2015; Graunke, Woosley, & Helms, 2006; Sparkman, Maulding, & Roberts, 2012). While the narrow focus of the study and the differences in research sites and study participants may account for the unexpected findings, future research may indicate that there consistently exists no relationship between community college student success in developmental mathematics and non-cognitive traits. Implications for future research are outlined next.

Limitations

The small number of response items within the TypeFocus™ Success Factors Questionnaire instrument may be one factor that limited the the researcher's ability to identify a

correlation between the dependent and independent variables. While the instrument was deemed valid and reliable following factor analysis and Cronbach's Alpha analysis, the subscales for each trait were measured by participants' responses to only three items per trait. Best practices within the field of quantitative research support that a small number of items mapping to each trait subscale may be only minimally adequate to provide strong reliability and validity (Statistics Solutions, 2018). While the measurement model validity of the questionnaire was deemed strong, the outcome may have been different for the present study if there were more questionnaire items to generate the respondents' scores related to each non-cognitive trait of interest, Goal Persistence and Willing to Compete.

Furthermore, the TypeFocus™ instrument as a whole was developed to determine career fit based on respondents' personality type, interests, and work-related values. Each of these three aspects of the instrument were developed based on existing, well-known instruments commonly used within higher education for the purpose of career guidance (TypeFocus, 2018). The Success Factors Questionnaire component of the TypeFocus™ instrument was developed as an additional tool for helping students build awareness of attributes that support academic success, but its development was not based on a similar existing, well-established instrument. Since the TypeFocus™ instrument was not intended as a measure of non-cognitive traits as they relate to course success, the use of a different instrument specially designed to measure students' non-cognitive traits may have yielded different findings.

In addition to instrument selection, another limiting factor of this dissertation study was the use of only one site institution. While the focus on community college students was an important aspect of the study due to the specific challenge that community colleges experience with course placement practices and developmental coursework, the generalizability of the

results is minimal due to the use of only one college for data collection. Future studies should aim to gather student data from multiple sites, possibly within the same state or region of the United States. Broadening the study in this way would also broaden the implications for the study's findings to the state or regional level, instead of one institution in one city.

Implications for Future Research

Prior to this dissertation study, the researcher hypothesized that a correlation would exist between community college students' developmental mathematics course grades and one or more of the non-cognitive traits that served as independent variables. This hypothesis was based on existing research pointing to the connection between non-cognitive traits, and student success outcomes, such as retention, persistence, and graduation rates among various student populations (Bowman, Hill, Benson, & Bronkema, 2015; Graunke, Woosley, & Helms, 2006; Sparkman, Maulding, & Roberts, 2012). The study's findings do not support the hypothesis, but further exploration of the topic may prove worthwhile. Further research may be useful for community college practitioners interested in improving student success in developmental education programs, and developing more accurate course placement practices that better predict the potential for academic success among developmental studies students.

A different instrument may yield more beneficial results in future studies. The Grit Scale by Duckworth (2016) is an established instrument that may produce different results related to students' non-cognitive traits and success in developmental mathematics coursework. The use of the Grit Scale as a tool for examining student success in educational research has demonstrated consistent results supporting that Grit is a valuable measure of a student's potential for academic success (Duckworth & Yeager, 2015). The Grit Scale has been developed in a variety of languages, has been analyzed for reliability and validity across various demographics, and has

broad-based recognition across both academic and employment environments as a valid predictor of one's potential for future success (Duckworth & Gross, 2014; Stokas, 2015; Wolters & Hussain, 2015). The Grit Scale instrument is available in a format containing either eight or twelve items, addressing the issue with the TypeFocus™ instrument's lack of sufficient items to adequately measure the traits of interest. If the present study were repeated, the use of Duckworth's Grit Scale is strongly recommended as the instrument used to measure non-cognitive traits.

An additional opportunity for future research on this topic is to alter the methodology. The present study included only quantitative methodology, with data analysis to examine the relationship between the dependent variable and the independent variables of interest. While this methodology is useful for identifying whether or not variables are correlated, only including a quantitative approach limits the extent to which data can be generalized or applied in the field.

A subsequent study would add depth to the findings by including a mixed methods approach. Adding a qualitative component to the quantitative methodology could complement the study by including student experiences and perceptions. For example, conducting focus groups with students from a set of identified courses would allow the researcher to glean student perspectives about the characteristics and non-cognitive traits students believe most supported their academic success during a specific course. A survey of graduating students might include questionnaire items that ask students to self-identify the presence of non-cognitive traits and specify whether or not they considered these traits helpful. Additionally, a qualitative aspect could add insight regarding institutional traits, programs, and practices that students believe strengthened their ability to use non-cognitive characteristics, such as emotional regulation, goal-

setting, and self-efficacy. Higher education institutions would gain valuable information from further research on this topic.

This topic is of particular interest to community colleges, where student retention, graduation rates, and the overall value of a community college education are under ongoing scrutiny (American Association of Community Colleges, 2000; Boggs, 2009; Century Foundation, 2013; Community College Research Center, 2005, September). Community colleges would benefit from a strengthened understanding of how to most effectively predict student success at all academic levels, and from the ability to move beyond cognitive predictors of success (Handel & Williams, 2011). Additional research to explore how students' non-cognitive traits are tied to their success in both developmental-level and college-level courses may yield positive impacts on institutional practices. Specifically, examining the predictive validity of cognitive measures of student success such as high school GPA and standardized tests, and comparing to the predictive validity of a non-cognitive measure of student success such as the Grit Scale, may help to inform decisions about course placement practices in the community college environment. This is of particular interest due to existing criticisms that cognitive measures tell only part of the story regarding a student's potential for academic success (Burdman, 2012; Ngo & Kwon, 2015). Although the results of the present study do not support the use of non-cognitive measures in community colleges and the adjustment of course placement approaches, prior research does support changes to institutional policy and practice.

Implications for Policy and Practice

Non-cognitive traits such as those measured by the Grit Scale (Duckworth, 2016) and Emotional Intelligence (Goleman, 1995) instruments have received attention from professionals in a variety of professional fields. Psychologists, educators, and employment managers are

among those who have found that individuals with traits such as emotional regulation, autonomy, self-efficacy, motivation, and goal commitment are more likely to succeed personally, professionally, and academically (Anestis & Selby, 2015; Barchard, 2003; Chapin, 2015; Duckworth & Yeager, 2015; Graunke, Woosley, & Helms, 2006; Martin, Galentino, Townsend, 2014).

The purpose of this dissertation study was to understand the relationship between students' non-cognitive traits and final grades in developmental-level mathematics courses. Based on a review of the literature about non-cognitive traits as predictors of success, the study was intended to glean new information to help solve an existing issue within the higher education field: inadequate course placement practices resulted in a large number of students misplaced into developmental pathways within community colleges (Burdman, 2012; Center for Community College Student Engagement, 2016). Since remedial education was identified as a barrier to successful transfer and graduation from community colleges, the issue of misaligned course placement practices is a relevant one for improving student success at America's 2-year institutions (Bailey, Jeong, & Cho, 2010; Chen, 2016; Crisp & Delgado, 2014; Handel & Williams, 2011). The researcher for this dissertation elected to focus on remedial mathematics course placement practices due to the particularly low success rates among students enrolled in this level of mathematics coursework (Cafarella, 2016; Cox, 2015; Fong, Melguizo, & Prather, 2015). Practitioners in the higher education field have explored course placement practices and possible revisions to the decades-old approach to determining students' course levels based on standardized tests (Handel & Williams, 2011; Melguizo, Kosiewicz, Prather, & Bos, 2014).

With this exploration of course placement practices came insight that drove initial changes to practices within higher education. One such change was that many community

colleges moved to placing students into courses based on factors other than just standardized tests, expanding to use students' high school GPA or prior course experiences as an alternative (Burdman, 2012; Ngo & Kwon; 2015). Aligning with the traditional use of standardized tests, these revised approaches acknowledged the need for change but still relied heavily on cognitive measures as predictors of college success (Center for Community College Student Engagement, 2016; Cohen, Brawer, & Kisker, 2013).

Pressed to improve overall student success and with the knowledge that faulty remedial education programs were part of their student success problem, community college practitioners began examining options to move students more swiftly through developmental pathways and prevent enrollment into developmental courses when possible (Burdman, 2012; Center for Community College Student Engagement, 2016). This push for alternatives and solutions lead many institutions to use non-cognitive measures as predictors of student success, often in concert with or replacing cognitive measures (Burdman, 2012; Ngo & Kwon, 2015; Sparkman, Maulding, & Roberts, 2012).

Based on the supporting literature, this researcher recommends that community colleges take steps to reduce the use of standardized tests for course placement due to the tests' questionable ability to predict student success (Center for Community College Student Engagement, 2016; Hoover, 2013; Soares, 2012; Syverson, 2007). Course placement policies that take into account students' non-cognitive abilities instead of only considering cognitive abilities broaden educational access for students who are underserved within community colleges (Sandoval-Lucero, Maes, Klingsmith, 2014; Soares, 2012; Syverson, 2007). Furthermore, students who possess traits such as persistence, motivation, and help-seeking may succeed in courses for which they are underprepared because they have these non-cognitive skills that were

shown to support college student success (Duckworth & Gross, 2014; Hoover, 2013; Strayhorn, 2014). Practitioners and institutional decision-makers should no longer assume that cognitive abilities alone will tell the story of a student's potential for success in college.

One approach to incorporating non-cognitive measures into the course placement process is to have students complete both a standardized placement test and a measure of non-cognitive traits such as the Grit Scale (Duckworth, 2016). Institutions can then use the placement test score as a starting point for identifying course placement level, and then adjust the level upward if the student possesses a strong non-cognitive score. One example of a student who may gain from this approach is one who places toward the top of the remedial pathway, and holds a strong score related to non-cognitive traits; placement into a college-level course would be sensible due to the increased likelihood that the student will succeed because of their non-cognitive strengths. This approach accelerates the student's progression through the remedial pathway and into college-level coursework. Creating accelerated pathways through developmental education is one strategy for improving student retention and completion rates (Burdman, 2012; Center for Community College Student Engagement, 2016).

Another method for incorporating non-cognitive measures into the course placement process is to eliminate the use of standardized placement tests and use a combination of high school GPA, high school coursework, and non-cognitive measures to determine course placement levels. A framework for this approach may be that students with a GPA of 3.0 or better place into college-level courses, but move into more advanced courses if they successfully completed relevant high school courses. High school course grades may also play a role in determining whether or not a student can move into more advanced courses, and those who earned less than a grade of B in the relevant high school courses may be permitted into the

advanced level only if their non-cognitive score is strong. The various factors, often referred to a multiple measures, specified in this sample framework are considered collectively to determine which course placement level is best for a student (Burdman, 2012; Ngo & Kwon, 2015).

Applications of non-cognitive measures for student success extend beyond course placement practices, although this dissertation focused on non-cognitive traits and course grades as an opportunity to adjust course placement approaches within community colleges. An additional use of non-cognitive measures is to have all new students complete an instrument that measures non-cognitive traits during the college admissions process or as part of a first year experience course. Instructors can then receive a profile of their students' non-cognitive strengths and weaknesses in order to cater classroom learning experiences toward strengthening student characteristics known to support success. For example, a first year experience course instructor could implement a series of activities within the course to allow students the chance to explore their academic and career interests and goals in an effort to increase goal commitment and motivation. A Student Life program could offer a series of engagement opportunities online and through face-to-face interactions with the intent of developing students' emotional intelligence so that the related skills might encourage appropriate peer-to-peer and student-to-faculty interactions known to foster success (Duckworth & Gross, 2014; Harvard Business Review, 2015). As discussed previously in this dissertation, institutions have the opportunity to influence student psychosocial development through campus programming, student engagement, and interactions with faculty, staff, and peers. These practices are referred to as environmental influences, and awareness of students' non-cognitive traits should inform decisions about how to direct these campus-wide efforts to grow and retain students (Chickering & Reisser, 1993).

Opportunities abound within America's community colleges to rewrite the current narrative regarding student success, retention, and graduation. Non-cognitive measures create deeper insights into students' potential for academic success, reaching beyond the traditional view that only academic preparedness and cognitive measures predict future success. Grit (Duckworth, 2016), for example, is thought to provide a better prediction of success than intelligence. Stokas (2015) stated that research about Grit, "has shown that high-achieving individuals are not necessarily the most talented but rather are able to push through setbacks and sustain their interest despite discomfort or unpleasant moments in order to attain goals" (p. 513). Indeed, this idea that people would persevere despite challenges is a skill that higher education personnel crave to observe and desire to grow within their students. Research suggests that a greater focus on non-cognitive measures is an under-recognized tool for improving student success outcomes.

Conclusion

This dissertation study produced results that did not align with prior research on the topic related to non-cognitive measures of student success. Opportunities exist to improve the research methodology and possibly yield more meaningful findings to add to the dialogue regarding the value of non-cognitive traits as predictors of student success within two-year institutions. However, the existing body of literature on this topic is plentiful and supports the notion that higher education institutions should reconsider the use of cognitive predictors while exploring how best to incorporate non-cognitive measures into course placement practices and institutional programs to foster academic success. Better understanding students' non-cognitive traits will prove useful as community colleges strive to demonstrate that these institutions provide valuable opportunities and meet accountability measures for improving access, retention, and completion.

APPENDICES

Appendix A

Letter of Support from Research Site Institution

York Technical College

One College. Many Opportunities.

September 6, 2017

Kerri McGuire
Doctoral Candidate
Educational Leadership - Higher Education
Clemson University
Clemson, SC 29634

Dear Ms. McGuire:

This letter grants permission for you to use York Technical College as the site for your dissertation research study entitled *An Examination of the Relationship Between Non-Cognitive Measures and First-Semester Math Course Success Among Community College Students: Implications for Course Placement Practices and Curriculum Decisions*. Your non-experimental study aims to analyze existing student data to understand the relationship between students' success or non-success in math courses, and a measure of non-cognitive student traits from the TypeFocus™ assessment tool.

As such, you are permitted to conduct statistical analysis using existing student data that is accessible through the College's Student Information System (SIS) and the TypeFocus™ assessment administrator website. Appropriate data may be made available to you through (1) extraction from the SIS by a member of the Office of Institutional Research and Effectiveness, and/or (2) by your own access to the SIS and the TypeFocus™ website for purpose of obtaining needed data for students identified as participants in the study.

A FERPA exception is being granted solely for the purpose of this study. Student data that are available to you include name, date of birth, unique college ID number, gender, race/ethnicity, standardized test scores, course history, final course grades for mathematics courses, and scores on the TypeFocus™. It is understood that you will delete all unique student identifiers from your data set after using this information to match students' scores on the TypeFocus™ to their math course grades and demographic data. Unique student identifiers, such as name and college ID number, will not be recorded as part of the study.

It is agreed that student confidentiality and privacy will be upheld throughout the study, and results will be reported in the aggregate so that individual students are unidentifiable. Additionally, York Technical College will not be identified, and you agree to share any research findings that may be of interest to the College.

Sincerely,

Mary Beth Schwartz, PhD
Director
Institutional Effectiveness & Research

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